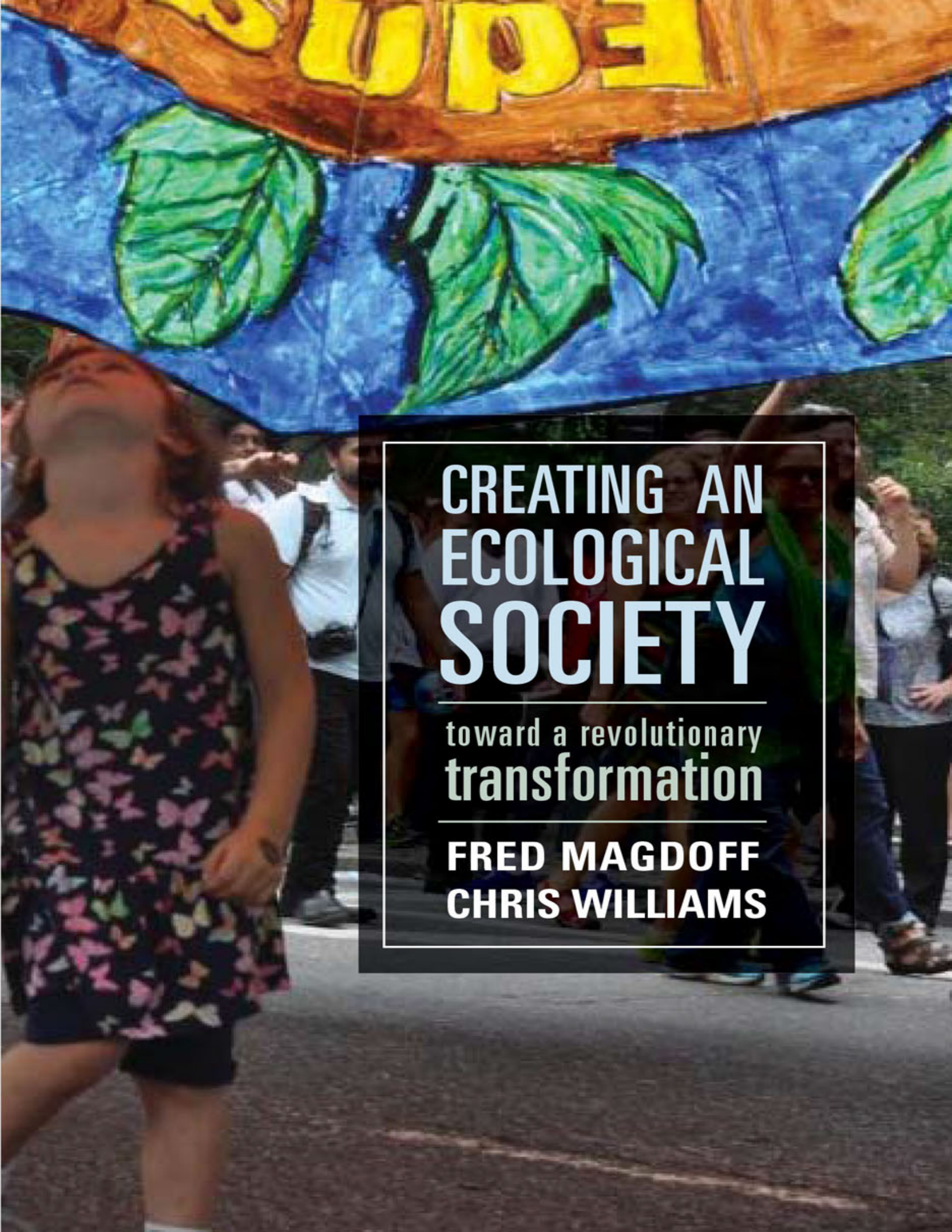
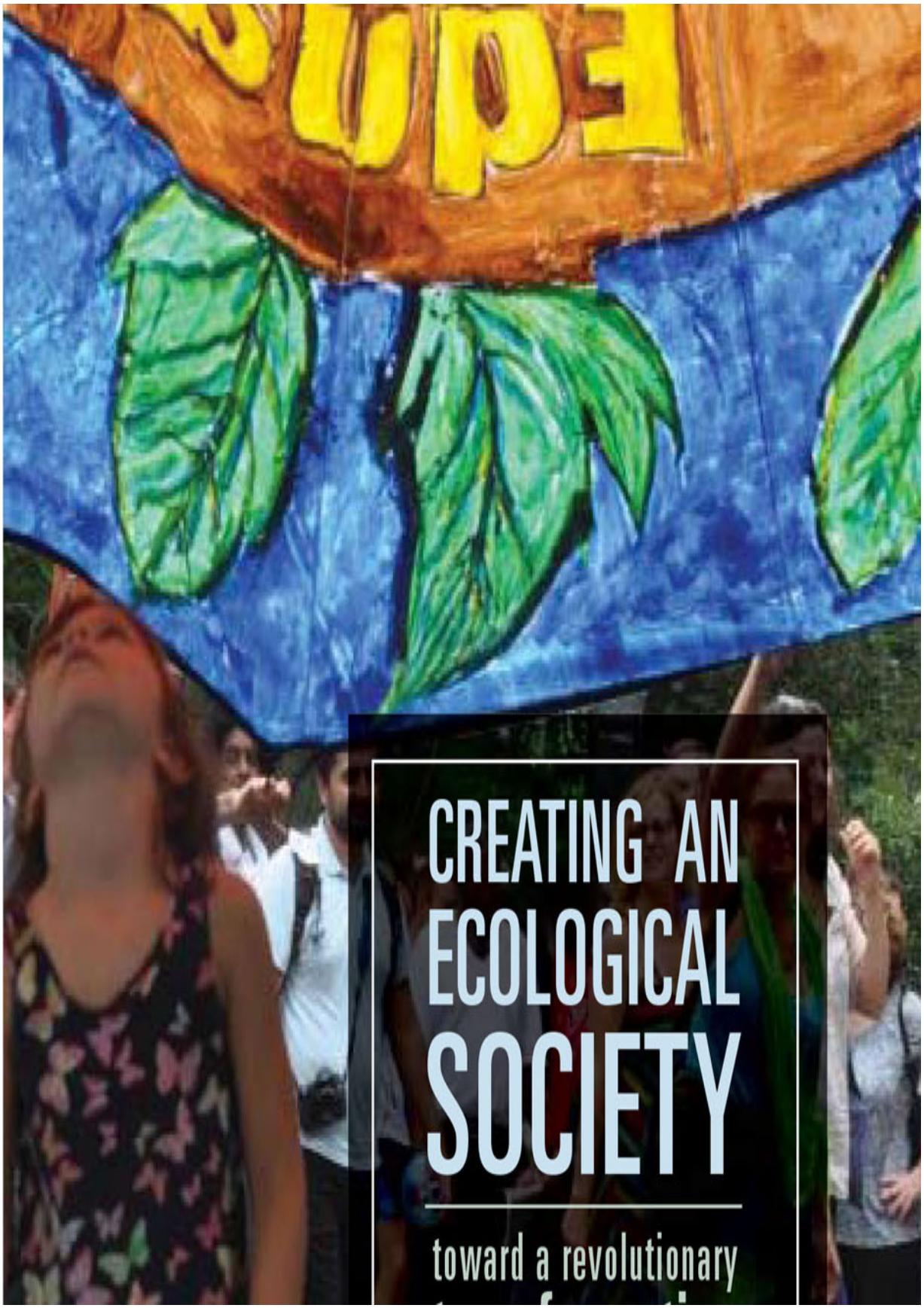


CREATING AN ECOLOGICAL SOCIETY

toward a revolutionary transformation

FRED MAGDOFF
CHRIS WILLIAMS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PRAISE FOR
CREATING AN ECOLOGICAL SOCIETY

"Pushing back against pervasive and debilitating pessimism, Magdoff and Williams have revived the hard work of imagining what an eco-socialist future might actually involve."—**CHRISTIAN PARENTI**, author, *Tropic of Chaos Climate Change and the New Geography of Violence*

"Makes a convincing urgent call for a decisive choice to revolt and to transform our lives and replenish our planet … through … social and environmental justice."—**DANNY GLOVER**, Citizen-Artist

"A comprehensive, systematic map of the dire straits we're in and the way out. Dispels the myth that human nature is to blame and puts the necessary confrontation with capitalism front and center."—**ANDREAS MALM**, author, *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming*

"With a remarkable command of the science on why our planet is dying and inequality is growing, the authors also provide ample hope about how to radically transform our toxic political, economic and social systems. By borrowing from the beautiful intelligence of other species and building profoundly new relationships with nature, our food, our cities, our governments and each other, we're shown in these pages that a revolution is not just possible, but it might actually bring us great happiness."—**JOANNA KERR**, Executive Director, Greenpeace (Canada)

"This book offers building blocks for a socio-ecological revolution and human salvation. Read it and join in imagining and creating a vibrant, just, and ecologically nourishing world."—**JAMES EARLY**, former Director, Cultural Heritage Policy, Smithsonian Institution

"A clear and comprehensive diagnosis of the climate crisis, the role of capitalism, and a revolutionary alternative. *Creating an Ecological Society* is a road map to a sustainable future."—**DAVID BARSAMIAN**, host, *Alternative Radio*

“A brilliant resource for green-lefts and left-greens! Magdoff and Williams don’t just describe the global environmental crisis, they identify its root causes, and lay out a program for building a truly ecological society.”—**Ian Angus**, author, *Facing the Anthropocene: Fossil Capitalism and the Crisis of the Earth System*

“Gives us a socialist vision of a socially just and ecologically sustainable world, and offer some arguments as to how we might get there.”—**Martin Empson**, author, *Land and Labour: Marxism, Ecology and Human History*

“… an eloquent encyclopedia of eco-social rebellion.”—**John Riddell**, author, *To the Masses: Proceedings of the Third Congress of the Communist International, 1921*

“Boldly confronts the grave risks capitalism poses to humanity and the planet and argues with passion and conviction as to how we can find solutions in the society and nature already around us and not in some futuristic technology or political savior.”—**Arun Gupta**, founder of *The Occupied Wall Street Journal* and contributor to *The Guardian, Salon, Al Jazeera America*, and *The Nation*

“The impressive blending of biological with social, of elegiac narrative with practical instructions, will surely make *Creating an Ecological Society* a memorable and indispensable companion in the ecosocial revolution already underway.”—**Subhankar Banerjee**, Lannan Chair and Professor of Art & Ecology, University of New Mexico

“To heal the rifts between society and nature, and create a system of co-evolutionary human development, we need a materialist social ecology that can serve as an instrument of worker-community struggles in and against capitalism. Magdoff and Williams pursue this project forthrightly and relentlessly.”—**Paul Burkett**, professor of economics, Indiana State University, Terre Haute; author of *Marx and Nature: A Red and Green Perspective*

“Remarkably clear, wise, balanced, well written, and at times poetic, this important book takes on one of the great questions of our time.”—

JONATHAN NEALE, author, *Stop Global Warming, Change the World*

CREATING AN ECOLOGICAL SOCIETY

Toward a Revolutionary Transformation

by FRED MAGDOFF *and* CHRIS WILLIAMS

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Foreword

AS FRED MAGDOFF AND CHRIS WILLIAMS POINT OUT in their new book, *Creating an Ecological Society*, the word "ecology" (originally œcology) was first coined in 1866 by Ernst Haeckel, Darwin's leading German follower, based on the Greek word *oikos*, or household. Ironically, the word "economy," to which ecology is often nowadays counterposed, was derived much earlier from the same Greek root—in this instance *oikonomia*, or household management. The close family relationship between these two concepts was fully intended by Haeckel, who defined ecology as the study of Darwin's "economy of nature."[1]

What the ancient Greeks had to offer to the understanding of today's ecological predicament, however, extended well beyond such linguistic roots. In Greek poetry, drama, and philosophy, one already finds a powerful intuitive grasp of the twofold estrangement of nature and society brought into being by the development of a commercial money economy, leading to the conflict between a system of wealth that was unlimited in its aspirations—set against a world of natural limitations. From Aristophanes' *Wealth* to Aeschylus's *Oresteia* to Aristotle's *Politics* to Epicurus's *On Nature*, and—in Roman times—to Lucretius's *De rerum natura* and Ovid's *Metamorphoses*, the classical critique of unlimited acquisition is a theme that is repeated over and over. For Epicurus, "The wealth demanded by nature is both limited and easily procured; that demanded by idle imaginings stretches on to infinity." He added: "Nothing is sufficient for him to whom what is sufficient seems little"—thus, "unlimited wealth is great poverty."[2]

Greek and Roman mythology dramatized the contradiction between the pursuit of unlimited wealth and ecological limits in numerous places, the best known of which is the legend of Midas. But the most poignant of all—as Richard Seaford declared in "The Ancient Greeks and Global Warming," his presidential address to the British Classical Association in 2009—is the myth of Erysichthon.[3] In the version provided by Ovid in his *Metamorphoses*, King Erysichthon of Thessaly cuts down a massive ancient

oak tree in the sacred grove of the goddess Ceres (Demeter) in order to build a banquet hall. In the process he kills those who stood in his way, inviting down upon himself the curse of a dying dryad or tree nymph. Ceres, responding to the pleas of the dead nymph's sisters, punishes him by calling upon the goddess Famine to enter his body and breathe her essence into him, giving him an insatiable search for wealth and consumption:

> *Just as the sea receives from round the world*
> *its rivers, and is never satisfied,*
> *no matter from what distant source they flow,*
> *and as a raging fire spurns no fuel,*
> *devouring innumerable logs*
> *and wanting more with every one it gets,*
> *growing more voracious from abundance,*
> *just so the greedy lips of Erysichthon,*
> *even as they took in, were seeking out;*
> *the cause of one feast was the one before,*
> *and all his eating only left him empty*.[4]

Erysichthon seeks to extract everything from nature and the world around him and in the process sells his own daughter in marriage, from which she escapes (by means of shape-shifting), but returning to him only to be resold again—a process that is repeated over and over. Erysichthon's fate is quite different from that of Midas, who, in Ovid's *Metamorphoses*, is eventually released from his ill-considered wish, granted by the god Bacchus, of turning everything he touches into gold, and who then turns to the worship of the god Pan and nature. In contrast, Erysichthon eventually eats himself as a product of his insatiable desire for more. According to Seaford, the myth of Erysichthon "contains a unique combination of unusual features: the transformation of nature into a product, selling to obtain food, and eating the self. The constant return of the daughter from marriage excludes progeny (the future). The Greeks had a myth for many of our central concerns, and here is one for global warming: exploitation of nature produces pathological insatiability, the unlimited need for a source of income that sacrifices the future, and self-destruction."[5]

How is it that ancient Greeks (and Romans) had such a powerful critique of unlimited wealth in a precapitalist economy? Seaford argues, based on his own seminal research in *Money and the Ancient Greek Mind*, that as the earliest society to introduce a systematic money economy based on coinage, the Greeks generated a concept of unlimited, abstract wealth that tore at the whole fabric of the Greek polis. It was this more than anything else, he indicates, that helped generate the sense of contradiction and estrangement of nature that came to pervade Athenian drama and philosophy.[6]

It is not until the rise of the generalized commodity economy of capitalism that one discovers as powerful a critique of the alienation of nature and its relation to the pursuit of unlimited wealth in a money economy, and then it is frequently overridden by the notion of the mastery and the domination of nature and the struggle over class and production. Writing of the alienation (the sale) of nature in terms of *land*, which in classical political economy had stood for nature as a whole, Karl Polanyi stated in *The Great Transformation*:

> What we call land is an element of nature inextricably interwoven with man's institutions. To isolate it and form a market out of it was perhaps the weirdest of all undertakings of our ancestors…. And yet to separate land from man and organize society in such a way as to satisfy the requirements of a real-estate market was a vital part of the utopian concept of a market economy.[7]

Those opposing the rise of industrial capitalism in the eighteenth, nineteenth, and early twentieth centuries tended to split between Romantics, who deplored the destruction of nature, and socialists, who were concerned almost exclusively with the class struggle. However, a number of thinkers whose worldviews can be properly described as dialectical, drew from both traditions, recognizing (albeit in different ways) that the alienation of nature and the alienation of labor were two sides of the same coin, and related to production. Among the most radical and perceptive in this regard were such diverse figures as William Blake, P. B. Shelley, Karl Marx, Frederick Engels, John Ruskin, and William Morris.

It is here in the context of the Industrial Revolution that natural science also began to exert a critical influence. Throughout the growth of modernity, the notion of the "domination" or "mastery of nature" was seen as referring to the harnessing of the powers of nature by means of science and technology. Even for Francis Bacon such mastery of nature was seen as only possible by following nature's laws, with the result that some of his earliest seventeenth-century followers, such as John Evelyn, the author of *Fumifugium* (a treatise on air pollution) and *Sylva* (a treatise on deforestation), pioneered in raising issues of conservation and environmental management.[8] The eventual triumph of evolutionary theory in the nineteenth century with the publication of Charles Darwin's *The Origin of Species* in 1859 encouraged an understanding of the historicity of nature, and ultimately processes of co-evolution.

At the same time, the discovery in the nineteenth century of the concept of metabolism in cell physiology and its spread to other fields, coupled with the rise of thermodynamics, pointed within science to the rise of a more unified organic view of what Blake and many others had metaphorically called the "Web of Life."[9] Among the first to see the larger implications of the concept of metabolism was Marx, who defined the labor process as the "social metabolism," thereby tying the critique of alienation of labor and the alienation of nature under capitalism, to a materialist-scientific worldview.[10] Aspects of this developing ecological view are to be found in the work of the zoologist Ray Lankester, Darwin and Thomas Huxley's protégé and Marx's close friend. But it was not until Arthur G. Tansley, Lankester's student, introduced the concept of ecosystem in 1935, drawing on sources as diverse as Lucretius in ancient materialism and Marxian conceptions of science, that the critical-dialectical potential of ecology came to the fore. "Ecology," Tansley argued, "must be applied to conditions brought about by human activity."[11]

Tansley's ecosystem analysis was introduced in part as a critical-materialist response to idealist and racist conceptions of ecology prevalent in his time.[12] The emerging ecosystem critique, however, was drowned out by other developments. In the late 1930s and 1940s a general conflagration ensued in the form of the Second World War. In the aftermath of the war, faith in the power of science and technology was at its height, and with it the belief in "human exemptionalism."[13] Nothing could have been further

from the popular mind of the immediate postwar period than the notion of natural limits. Yet it was in this same period, which we now associate with the Great Acceleration and the emergence of the Anthropocene epoch, that ecology began to come into its own, both as an integrative science and as a critical standpoint on the development of capitalist society.[14] The first great ecological revolt of the postwar period was the struggle of scientists internationally in the 1950s against aboveground nuclear testing. Hence, it is no accident that the Partial Nuclear Test Ban Treaty, which was the eventual result of this scientific revolt, in which figures like Albert Einstein, Linus Pauling, and Barry Commoner played important roles, was finally concluded around the time of the publication of Rachel Carson's *Silent Spring*—usually thought of as signaling the rise of the modern ecology movement. Carson applied the new specters of bioaccumulation and biomagnification of radiation (the processes whereby toxins accumulate within organisms and then are magnified at higher levels of the food web) to the way in which this was also manifested by synthetic chemicals in pesticides (which she called "biocides")—with both the nuclear and biocide threats having emerged out of scientific advances within war industry.[15]

Of greater long-run significance perhaps than *Silent Spring* itself was Carson's 1963 speech, "The Pollution of Our Environment," in which she introduced the concepts of ecology and ecosystem to the U.S. public.[16] Within a decade, ecology took off as both a scientific field and as a social-political movement, each feeding on the other. This was evident in the appearance of a whole issue of *Scientific American* in 1970, introducing the concept of the biosphere to the wider population, and by the publication in the following year of Commoner's *The Closing Circle*—the first in a series of pathbreaking works, which included *The Poverty of Power* (1976) and *Making Peace with the Planet* (1990). In this analysis, Commoner brought together the critique of the capitalist ecology and the critique of the capitalist economy. "If the environment is polluted and the economy is sick," he wrote in *Making Peace with the Planet*, "the virus that causes both will be found in the system of production."[17]

As David R. Keller and Frank Golley explain in *The Philosophy of Ecology*, "ecology is a science of synthesis"—directed at a world of widening ecological rifts. Ecology, they write,

is captivating due to the sheer comprehensiveness of its scope and complexity of its subject matter; ecology addresses everything from the genetics, physiology, and ethology of animals (including humans) to watersheds, the atmosphere, geologic processes, and influences of solar radiation and meteor impacts—in short, the totality of nature….

The word *ecology* connotes "ecological worldview." An ecological worldview emphasizes interaction and connectedness. The theme can be developed in several ways:

1. All living and nonliving things are integral parts of the biospherical web (ontological connectedness).
2. The essence or identity of a living thing is an expression of connections and context (internal relations).
3. To understand the makeup of the biosphere, connections and relations between parts must be considered, not just the parts themselves (holism).
4. All life forms—including *Homo sapiens*—result from the same processes (naturalism).
5. Given the affinities between humans and nonhumans, nonhuman nature has value above and beyond instrumental, resource utility for human beings (nonanthropocentrism).
6. Humans have caused serious negative impacts (pollution, anthropogenic extinction) on the earth, leading to the need for environmental ethics.[18]

In short, ecology raises the kinds of complex and interconnected relations and contradictions in the human interface with the web of life that is traditionally associated with a materialist-dialectical worldview.[19] It should not be surprising, therefore, that although ecology was for decades viewed exclusively as a specialized scientific pursuit, the concept has now taken on a popular, political meaning related to environmentalism. Yet the science of ecology and the politics of ecology, while different, have come to feed into each other in present-day society, since the science itself points continually to anthropogenic rifts in natural processes and the degradation of ecosystems (and increasingly the Earth system), resulting from human production.

In the Anthropocene, we live in an age where the implications of ecological science are radical—often more radical than mainstream environmentalism itself, which is trapped in the purely incremental, ameliorative social status quo. Figures like Rachel Carson, Barry Commoner, and the late Richard Levins, as well as many others, thus point toward the need for social-system change on a massive scale. For Carson, speaking in terms the ancient Greeks would undoubtedly have understood: "The modern world worships the gods of speed and quantity, and of the quick and easy profit, and out of this idolatry monstrous evils have arisen."[20] Marx, observing the emergence of ecological concerns within soil science in his day, called this "an unconscious socialist tendency," in the sense that it pointed to the need for a shift to a society governed by the associated producers, which would rationally regulate the metabolism of humanity and nature.[21]

Magdoff and Williams are among the foremost heirs to this broad heritage of ecological thought within science and social criticism. Magdoff is by profession a soil scientist and ecologist. Williams is a science educator. Both have wide backgrounds as well in the critique of capitalist political economy. Magdoff is coauthor of *The Great Financial Crisis* (2009) and *What Every Environmentalist Needs to Know About Capitalism* (2011)—both with the present author. Williams is the author of *Ecology and Socialism* (2010).[22] Both exemplify the new tradition of ecosocialism, rooted in a natural-scientific understanding of ecology and exploring the evolution, interconnections, limits, and resilience of natural systems. They stress the dangers of a society in which accumulation of profits is based on the exploitation of humanity and the expropriation of nature. It is their ability to bring these various aspects of our present-day reality together in an interconnected, and ultimately hopeful, ecological worldview that constitutes the great value of their book. They seek to transcend two one-sided views: that of ecologists who do not yet recognize that capitalism is the main source of our unprecedented levels of ecological disruption; and that of leftists who have not yet recognized that ecological imperatives are "allies" in the global struggle.[23]

Today the world is faced with an epochal crisis with two interconnected features. On the one hand, this is a crisis of the over-accumulation of capital, leading to economic stagnation, and the financialization of all

aspects of life, manifested in the pervasiveness of debt. This is tied to imperialism and to the widening of human oppression in all its forms—including oppressions of gender, race, and the general devaluation of almost all individuals in today's global capitalist culture. On the other hand, there is the Anthropocene crisis marked by the continuing acceleration of human impacts on the environment and the crossing of numerous planetary boundaries—the best known of which is climate change, but also including the decline in genetic diversity, ocean acidification, the rifts in the nitrogen and phosphorus cycles, loss of freshwater resources, changes in land use, chemical pollution, and other ecological rifts. Magdoff and Williams courageously face up to these cumulative contradictions, examining the epochal crisis of our times in its entirety and its relation to capital accumulation, while providing an ecological and socialist exit strategy—one that builds on the strengths of natural science and social science, critical ecology and critical economics.

Creating an Ecological Society, despite its engagement with the most serious problems of our time and its deep realism, is an irrepressibly optimistic work—at a time when most environmental analyses seem to be about simply digging in and awaiting a planetary disaster made inevitable by acquiescence to the existing system. It's not too late, the authors argue, to address the ecological problems facing us. Time is a factor, of course, but what is required in this situation is a speeding up of the process of social transformation and thereby the creation of new integrative levels of social existence. The movement toward socialism, that is, toward a society of ecological sustainability and substantive equality, will have to proceed much faster: by big steps, if not leaps. We can no longer depend—if we ever could—on a process of gradual evolution. Power must be wrested from the 1 percent. The expropriators must be expropriated. Our primarily quantitative society, geared always to more, and enforcing a perpetual deprivation in the population, must give way to an emphasis on qualitative human relations and a more sustainable relation to the environment.

Creating an Ecological Society presents a forward-looking perspective, which derives from three qualities that characterize their analysis: (1) the unification of all the major social-ecological problems, so as to transcend the contradictions of the usual reductionist ways of seeing; (2) a pedagogical approach in which the goal is to map out the social and

ecological terrain of struggle for mass popular movements; and (3) the ability to project concrete, meaningful, and practical solutions to problems that are insoluble within the confines of the present system—but only if we are willing to be revolutionary enough to break with the present. Thus oppressions of class, race, and gender are not afterthoughts in an ecological analysis; they are the very nodes of struggle in which an ecosocialist society will be built.

Along the way Magdoff and Williams teach us many things: About Marx's metabolic rift and the "three rifts" in the soil-nutrient cycle. About the relation of soil to climate change—where they provide a real scientific basis for understanding the importance of the soil's potential impact on atmospheric carbon dioxide levels. About the growth of epigenetics and its relation to the "triple helix" of gene, organism, and environment, pointing to the breakdown in genetic determinism.[24] About how race and gender are tied into environmental injustices. About the construction of healthy cities. All of this is presented in terms as clear as crystal, and crystallized in proposals for revolutionary ecological and social change.

Marx once wrote that humanity "inevitably sets itself only such tasks as it is able to solve, since closer examination will always show that the problem itself arises only when the material conditions for its solution are already present or at least in the course of formation."[25] One cannot read Magdoff and Williams's book without recognizing that the dire crises associated with our present globalized (and at the same time localized) problems are capable of solution—since the material and human resources for doing so already exist. Never before in human history has the need for change been so great. Yet, it is a struggle, they tell us, that can only be won by "revolution" as a "continuous process"—unceasing radical change.

"After more than two and a half millennia," Seaford writes, "money remains isolating, unlimited and homogenizing. Unlike us, who either do not see this or take it for granted, the Greeks were struck and sometimes horrified by it. Aristotle maintained that using money to make money is—in contrast to other forms of economic activity—unlimited and unnatural."[26] Marx strongly seconded Aristotle's critique in this respect.[27] And yet today we live in a highly financialized system where we are frequently offered carbon markets as the only solution to global warming—as if accumulation and financialization were the answers to Earth system crisis. For such a

capitalist society, in which each expansion is only the basis for the next expansion ad infinitum, everything is turned into a commodity to be sold for the highest profit: the tape by which efficiency is measured. The end prospect of the continuation of capitalist business as usual is thus the fate of Erysichthon:

> *But when at last his illness had consumed*
> *all that she brought him, and he still craved more,*
> *the wretched man began to tear his limbs*
> *asunder, mangling them in his maw,*
> *and fed his body as he shrank away*.[28]

None of this is foreordained, as in a Greek tragedy. Rather, the challenge before us, Magdoff and Williams declare, is to join the struggle to *create an ecological society: a revolutionary transformation of the present.*

—October 14, 2016
Eugene, Oregon

Preface

I met a traveller from an antique land
Who said: Two vast and trunkless legs of stone
Stand in the desert. Near them on the sand,
Half sunk, a shatter'd visage lies, whose frown
And wrinkled lip and sneer of cold command
Tell that its sculptor well those passions read
Which yet survive, stamp'd on these lifeless things;
The hand that mock'd them and the heart that fed
And on the pedestal, these words appear:
"My name is Ozymandias, king of kings:
Look on my works, ye mighty, and despair!"
Nothing beside remains: round the decay
Of that colossal wreck, boundless and bare.
The lone and level sands stretch far away.

—PERCY BYSSHE SHELLEY, "OZYMANDIAS"

AT SOME TIME IN THE FUTURE archaeologists may look at the rubble of a large twenty-first century city or other physical remnants of today's world and wonder, as Shelley's traveler surely would, what cataclysm struck that civilization. What caused such utter destruction, as occurred in the land of the "king of kings"? Without sweeping, systemic changes, the ominous trends in the world—ecologically the most momentous being global climate change, but additionally pollution of the seas, fresh water, soils, air, and people; soil erosion; biodiversity loss; use of renewable resources occurring faster than replenishment; and the depletion of nonrenewable resources—are unstoppable. The "business as usual" approach takes us on a clear pathway to planetary destruction.

A few years ago, Fred was speaking to a professor of environmental studies at a liberal arts college in the midwestern United States. The professor agreed with Fred's contention that a whole new system, having

new ways of relating to one another and the environment, was needed. But the environmental studies professor went on to explain that he did not talk to his students about it because any such change was so far off that he felt it was more important to talk about what might be done within the system in the near future to make things better. Finding out that systemic change was necessary, his students might become discouraged and immobilized by the enormity and long-term nature of the project. Fred's response was that if we don't begin thinking about what a new society might look like, how it might be organized, how it might work, and how it might be brought into existence—and start talking it over with others, especially young people—it will put the project off to the indefinite future. Any other response is counterproductive: it guarantees delaying precisely the kind of change the professor agreed was vital. If young people don't fully comprehend the depth of the crisis, its systemic nature, and the magnitude of the required changes, they will not be in the struggle as a lifelong commitment. Knowing the extent of change required can help avoid demoralization or getting sucked back into the realities of simply trying to survive in an unjust and unhealthy system.

This is the crux of the issue: *if we can't even imagine a different way of interacting with one another, the economy, and the resources we use and depend upon, then the struggle for a just and ecologically sound world recedes into the realm of utopian fantasy*. And without a vision for a plausible, genuine alternative, people understandably set their sights on reforms that will never add up to the immense changes that are needed.

But what could replace our current system? What might a truly ecologically sound and socially just society look like? Is such a thing even possible? If so, what would the basic organizational, economic, and ethical principles underlying such a society consist of? What are the forms of resistance, practices, and approaches needed to replace capitalism and start anew?

In attempting to answer these questions, we have divided *Creating an Ecological Society* into four parts:

Part One: Why an Alternative Is Essential (chapters 1–4) outlines where we are today, the severe social and ecological problems facing humanity, the systemic cause of the crises, and the ecological and social

consequences. We examine capitalism's role in creating and exacerbating these crises and their effects.

Part Two: Is an Ecological Society Possible? (chapters 5–7) surveys and evaluates supposed obstacles that are commonly said to prevent changing our economic system to an entirely new one—that our relationship to nature has to be one of domination, our inherent human nature prohibits transformation to a different socioeconomic system, and that the supposedly innate differences among groups of people of different ethnicities, races, classes, nationalities, or genders make an equitable society impossible.

Part Three: Learning from Nature (chapters 8–10) discusses basic ecological concepts, the characteristics of relatively stable and resilient ecosystems and how some aspects of these might apply to human society, and proposes a selection of ecologically sound technical practices for provisioning human needs.

Part Four: Toward a New Society (chapters 11–12) delves into how an ecological society could be organized, how it might operate, and how we might bring such a society into existence. An argument is made for a cohesive alternative system to replace capitalism. One that is democratic and equitable, organized and carried out to fulfill human needs in ways that regenerate and maintain a healthy biosphere. Even though much of our focus is on the country in which we live, what we have written is not meant to apply to a particular country or even region; such a system needs to extend across the globe.

Acknowledgments

This book is the result of a true partnership in which each author learned from the other. During the writing process we grappled with differing ideas and approaches, leading us to new ways of thinking about the complex issues we discuss. Chris would like to thank Fred for inviting him to participate in the project and co-author the book with him.

Our personal and intellectual debts to others in relation to this work are too vast to acknowledge in full. Participating and helping to organize demonstrations, protests, rallies, and meetings across so many years, and all

the people, comrades, and students we have met across the world has given us the strength, conviction, and energy to keep writing. We would like to thank especially those who read or commented on early drafts and put in many hours to offer us extremely useful and specific critical feedback: Hannah Holleman, Penny Gill, Jan Schultz, Ruth Perry, George Bird, Elise Guyette, Will Fritzmeier, Phil Gasper, James Early, John Foran, and Robert Dockhorn, as well as members of the study group on the growth economy and environmental sustainability at the Southampton Friends Meeting in Pennsylvania, who offered feedback on various chapters and/or the entire manuscript. We would like to thank copy-editor Erin Clermont and especially Martha Cameron and Erika Biddle for the countless hours and numerous ways in which they helped us to improve the manuscript.

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Chris would like to thank his partner, Hannah Holleman. Without her political acumen, passionate commitment, and steadfast support his contribution to this work would have been much delayed and markedly inferior. Fred would like to acknowledge his father, Harry Magdoff, who so shaped his general political outlook and understanding of social and economic issues. Finally, Fred would like to thank his partner, Amy Demarest, with whom he shares his life and the struggle for a humane and equitable ecological society.

—December 11, 2016

Burlington, Vermont and Amherst, Massachusetts

CREATING AN ECOLOGICAL SOCIETY

PART ONE

Why an Alternative Is Essential

1

The Social and Ecological Planetary Emergency

> They claim this mother of ours, the earth, for their own and fence their neighbors away; they deface her with their buildings and their refuse. The nation is like a spring freshet that overruns its banks and destroys all that are in its path.
>
> —SITTING BULL, LEADER OF THE HUNKPAPA LAKOTA SIOUX[1]

> Climate change is a social justice issue. With the climate crisis, as with the economic crisis, governments have prioritized the interests of those who caused the problem, despite the consequences for ordinary people. We are not "all in it together." An increased understanding of this has led the climate movement to grow in size and to adopt more radical slogans.
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> —SUZANNE JEFFERY[2]

ON JUNE 24, 2012, IN THE GALÁPAGOS archipelago, birthplace of Charles Darwin's theory of evolution, Lonesome George took his final breath. This giant Pinta Island tortoise, five feet long and over two hundred pounds, was the last surviving member of *Chelonoidis nigra abingdonii*. Giant tortoises can expect to live well into their second century. At roughly a hundred years old when he died, George was in the prime of his life.

A sad little note scrawled on a blackboard at the Darwin Research Station marked Lonesome George's death: "We have witnessed extinction. Hopefully we will learn from it."[3] But what can we learn from these giant tortoises? What can we learn from this irrevocable loss? What is the cultural, scientific, and biological significance of these tortoises to humans?

When the Spanish first landed on the islands 600 miles off the coast of modern-day Ecuador in the sixteenth century, giant tortoises numbered around a quarter million. Because they were so abundant, the archipelago was named after the old Spanish word for tortoise, *galápago*. Three centuries later, in his diary entry of September 15, 1835, Darwin noted what "seemed to my fancy like some antediluvian animals," which have "of course been greatly reduced." Darwin went on: "It is said that formerly single vessels have taken away as many as 700," though giant tortoises were still abundant when he made his visit.[4] On October 8, Darwin describes himself and the ship's crew as living "entirely on tortoise meat" and that "young tortoises make excellent soup," but he nevertheless found "the meat to my taste is indifferent."[5]

Almost inevitably, then, these giant tortoises formed part of Darwin's earliest musings on natural selection:

> When I recollect the fact that [from] the form of the body, shape of scales and general size, the Spaniards can at once pronounce from which island any tortoise may have been brought; when I see these islands in sight of each other and possessed of but a scanty stock of animals, tenanted by these birds, but slightly differing in structure and filling the same place in nature, I must suspect they are only varieties. The only fact of a similar kind of which I am aware, is the constant asserted difference between the wolf-like fox of East and West Falkland Islands. If there is the slightest foundation for these remarks, the zoology of archipelagoes will be well worth examining; for such facts would undermine the stability of species.[6]

The phrase "such facts would undermine the stability of species," written down for the first time in his notebooks documenting the five-year voyage of the HMS *Beagle*, point toward a theory that only emerged in print two decades later. Immediately recognized by the other revolutionary giant of the nineteenth century, Karl Marx, the importance of Darwin's *On the Origin of Species by Means of Natural Selection, or, the Preservation of Favoured Races in the Struggle for Life*, could not be overestimated. According to Marx, Darwin's book, published in 1859, was an "epoch-making work" that formed "the basis in natural history for our view,"

because it undermined the God-centered view of creation and gave life science a firm theoretical footing on solid materialist ground.[7]

Giant tortoises have existed on Earth for ten million years. In contrast, *Homo sapiens* have walked the Earth for approximately 200,000 years, a mere 2 percent of that time.* Yet in less than the life span of one individual giant tortoise, the subspecies has gone from numerous enough to fill the holds of ships to the extermination of all of *C. nigra abingdonii* by humans. In the world as it currently exists, the extinction of this giant tortoise leaves us not with the question "will we learn?" but with "which species will be threatened next?"

Perhaps it will be the leatherback turtle. The International Union for the Conservation of Nature (IUCN), the world's oldest and largest nature conservation organization, which compiles the Red List of Threatened Species, has placed this primordial leviathan on the "critically endangered" list—one category away from "extinct in the wild."

Relics of a distant past, leatherbacks have existed on Earth practically unchanged for 100 million years—ten times longer than the Galápagos tortoises. Next to the leatherback, *Homo sapiens* pales into temporal insignificance. Mature leatherbacks can be over six feet long, four feet wide, and weigh up to a ton. Able to swim to depths of 3,600 feet—over three times deeper than a nuclear submarine—leatherbacks change their body temperature to cope with the cold, their pliant shells allowing them to survive the immense pressure of the ocean depths.

To sit on a tropical beach in the middle of the night, close to an egg-laying mother, listening to the heaving power of her gargantuan lungs, gazing at a creature of such evolutionary perfection, is a deeply affecting moment. How much will humanity lose if these creatures are lost forever?

We don't know exactly what the average leatherback life span is, but we do know that species placed on the critically endangered list are likely to be extinct within ten years. Leatherbacks have experienced a population decline of more than 90 percent since 1980.

The turtles are threatened by the full gamut of economic activities dictated by the profit motive. Industrialized fishing methods, such as gillnet, trawl, and long-line fishing, trap the turtles as unwanted "bycatch." One study of Pacific Ocean turtles estimates that more than 200,000 loggerheads

and 50,000 leatherbacks are killed each year solely through inadvertent entanglement in long-line fishing.[8]

Just as turtles have become rare, the system responds and sets in motion further declines. Local consumption of turtles and their eggs was once a sustainable practice, but with the growth in world trade, a highly profitable multinational black market in turtle eggs has developed. While a turtle egg might sell for $1 in Costa Rica (a not insignificant sum considering a single nest can hold more than fifty of the perfectly round, pearl-white eggs), international consumption and smuggling associated with the drug trade means the price can reach as high as $100 to $300 per egg in international markets.[9]

As turtles return to the same beach that they were born on, largely unchecked coastal economic growth for tourism or real estate development is a further threat. Electric lighting on previously dark beaches confuses the turtles' navigation, resulting in fewer females making it onto land to lay their eggs.

Along with thousands of other species, leatherbacks are threatened with extinction by an economic and social system that is based on relentless, profit-driven expansion that promotes industrial fishing methods, chemical pollution, and egg harvesting for the black market. Which begs the question: How can we save these magnificent wild animals and, by extension, humans?

The current biodiversity crisis, whereby species are being driven to extinction at rates up to a thousand times greater than the geological statistical norm, is simply one aspect of a global ecological crisis. Whereas in the past such crises were local or regional, humans are now changing the whole biosphere in a multiplicity of ways: our actions are changing the chemical composition of the atmosphere; acidifying the oceans; contaminating the soil, the water, the air, and organisms worldwide with toxic chemicals; altering the land through deforestation of vast areas of tropical and boreal forests; and warming the entire planet. Whereas once we wiped out individual species, now we threaten whole biota.

The Age of Human-Induced Global Changes

The decline of sea turtle populations is but one example of the changes to global ecosystems that have been caused by human activity. Since the end of the last ice age about 12,000 years ago, humans have lived in the geological epoch called the Holocene. But according to the 2016 panel of geologists convened to examine the issue, in their report to the Geological Congress, we have now entered a new geological epoch: the Anthropocene, which is dominated by the activities of a single species. Scientists have drawn this conclusion from an analysis of the long-term impacts of human activities on the biosphere: climate change from fossil fuel combustion that increases carbon dioxide concentrations in the atmosphere and causes ocean acidification, plastic pollution, the disruption of the natural cycles of nitrogen and phosphorus by modern methods of agriculture, the widespread introduction of toxins into the environment, and the irradiation of the atmosphere from nuclear weapons testing.

One way of viewing these huge changes has been put forward by an international group of scientists who proposed nine planetary boundaries "within which humanity can continue to develop and thrive for generations to come."[10] We have already crossed or are close to crossing four of these nine boundaries—climate change, biosphere integrity, land-system change, and the nitrogen and phosphorus cycles. As lead researcher Will Steffen notes, "Transgressing a boundary increases the risk that human activities could inadvertently drive the Earth System into a much less hospitable state, damaging efforts to reduce poverty and leading to a deterioration of human well-being in many parts of the world, including wealthy countries."[11] One of the proposed boundaries is biodiversity, or "biosphere integrity." As Colin Waters and his colleagues note in *Science* magazine:

> Although Earth still retains most of the species that were present at the start of the Holocene, even conservative estimates of extinction rates since 1500 CE are far above mean per-million-year background rates, with a notable increase from the 19th century onward. Current trends of habitat loss and overexploitation, if maintained, would push Earth into the sixth mass extinction event (with ~75 percent of species extinct) in the next few centuries, a process that is probably already underway.[12]

The article goes on to note that the most significant reason for mass extinction is due to land-use changes and the restriction of "wild" nature to smaller and smaller areas. "The terrestrial biosphere has undergone a dramatic modification from 1700 CE, when almost 50% of the global ice-free land area was wild and only ~5% was intensively used by humans, to 2000 CE, when the respective percentages were 25% and 55%."[13]

Species evolve in interaction with one another and depend on the presence of others. Thus, when one species becomes extinct or shifts its range, detrimental effects may occur to the stability and survival prospects of other species and the healthy functioning of the ecosystem as a whole.

The Warming Planet

The Paris Climate Agreement, signed in December 2015 by world leaders from 194 countries and the European Union, states that human-caused climate change represents "an urgent and potentially irreversible threat to human societies and the planet" that will require "deep reductions in global emissions." The agreement notes "with serious concern" the "significant gap between the aggregate effect of Parties' mitigation pledges in terms of global annual emissions of greenhouse gases by 2020 and aggregate emission pathways consistent with holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels."[14]

The agreement goes on: "Parties should, when taking action to address climate change, respect, promote and consider their respective obligations on human rights, the right to health, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities and people in vulnerable situations and the right to development, as well as gender equality, empowerment of women and intergenerational equity."[15] Currently there is no mechanism in place to achieve these lofty—and urgently necessary—objectives.

Based on temperature records dating back to the nineteenth century, 2016 was the third year in a row to set a global temperature record. Compared to the base period of 1880-1920, the earth was warmer in 2016

by an average of 2.27°F (1.26°C), a level last seen over 100,000 years ago.[16] Even if we stopped all production of fossil fuels right now, today, we are already locked in to at least another 1.8°F (1°C) of average warming. The amount of warming guaranteed *if the Parties to the 2015 Paris Agreement do everything they say they're going to*, will put the world on track for a truly catastrophic warming of up to 7.2°F (4°C), warmer than the planet has ever been during our existence as a species. Scientists have estimated that the extra energy we have been putting into the atmosphere since 1998, by trapping more greenhouse gases, is equivalent to exploding four atomic bombs *every second*—over two billion nuclear detonations.[17]

The last time that global temperatures dropped below the twentieth-century average was February 1986. And the record heat of 2016 brought the world within touching distance of the 1.5°C maximal limit declared dangerous at the Paris meeting the previous year. As of September 2016, eleven of the twelve previous months had set monthly high temperature records. July 2016 set a record for the warmest month ever recorded and then August tied the record.

Such rapid warming of the land and sea is devastating, particularly as it combines with other impacts and leads to further instability and detrimental cumulative effects. The significance of turtles to humans and to the integrity of the ecosystem goes beyond their contribution to human culture and how they are simultaneously threatened by that culture. They are also natural predators of jellyfish, helping to keep their populations in check. As drift animals, jellyfish are swept into every ocean, and the gigantic leatherbacks migrate over vast oceanic distances to chase their prey. Since jellyfish are almost all water and not much protein, leatherbacks must eat huge quantities of jellyfish to stay alive. One study reports that in a single day leatherbacks eat 73 percent of their body mass in jellyfish, an amount that equates to several hundred lion's mane jellyfish per turtle.[18] With leatherbacks driven to near extinction, jellyfish populations have been proliferating, leading to another, even greater problem. Jellyfish subsist by eating huge quantities of fish eggs and fry. If jellyfish populations are not kept in check by their natural predators they will help to undermine the base of oceanic ecosystems.

But the ultimate threat to life on earth, particularly leatherbacks and other nesting reptiles that bury their eggs in sand, is rapid climate change

prompted by warming of the atmosphere and oceans—a fact recognized as early as 1953. In *The Edge of the Sea*, Rachel Carson explained the importance of a stable temperature to the oceans:

> Life in the aggregate is lived within a relatively narrow range of temperature. The fact that our planet Earth has a fairly stable temperature helps make it hospitable to life. In the sea, especially, temperature changes are gradual and moderate and many animals are so delicately adjusted that they cannot tolerate an abrupt or extensive change in temperature of the surrounding water. If such occurs they must migrate or die…. Now our climate is changing and we are moving into a warm cycle of unknown duration.[19]

Turtles lack sex chromosomes. Their genes do not directly determine whether a baby turtle is male or female. Instead, buried eggs take their gender cue from the ambient temperature of the sand. For leatherbacks, temperatures below 85°F (29.4°C) produce a clutch that is mostly male; above that, it's mostly female. With a relatively tiny 3.6°F (2°C) increase, a nest will produce all females, which is already beginning to happen.[20] A few degrees higher yet, and the "boiled" eggs don't hatch at all.

Unless we do something about limiting climate change to less than 2°C, these majestic creatures, from a species that is 100 million years old, will be driven to extinction because they will only produce females.

Warmer Oceans

The world's oceans are absorbing an estimated 90 percent of the excess heat generated by global warming.[21] The effects of the increasing water temperatures go way beyond affecting leatherback turtles. As Rachel Carson noted, species are forced to migrate to colder waters, displacing those already there. Greater rates of evaporation put more water vapor into a warmer atmosphere that can hold more water, thus leading to more severe downpours and extreme rainfall events.

Temperatures are increasing in the Arctic and Antarctic at greater rates than in the middle latitudes. As a result, over the last fifty years, Arctic Ocean ice has vanished from an area twice the size of Alaska and the

remaining ice is 50 percent thinner. The lowest maximum winter ice in thirty-seven years of satellite data occurred in February and March of 2016. The year 2016 tied with 2007 for the second lowest Arctic summer sea-ice level on record; the lowest occurred in 2012.[22] Later in the same year the situation became even more striking: “On October 20, 2016, Arctic sea ice extent began to set new daily record lows for this time of year.” When Arctic and Antarctic sea ice extents are combined for September through November 2016, the quantity is dramatically lower than for those months in any previous year on record.[23]

During the summer months ice reflects 50 percent of the sun’s rays, helping to cool and regulate planetary temperature. By contrast, open water absorbs 90 percent of incoming sunlight, warming the water even more. Warmer air temperatures play a major role in ice melt, as does the self-reinforcing impact of ice disappearing. In a classic example of a positive feedback loop, warming Arctic waters lead to more ice melt, which exposes more dark sea, which absorbs more heat, which melts more ice, and so on. It should come as little surprise that the loss of sea ice appears to be accelerating.

More and more evidence indicates that decreasing Arctic Ocean sea ice is altering the jet stream and already affecting weather patterns around the world.[24]

The accelerated melting of the gigantic Greenland ice sheet is as dramatic as the disappearance of Arctic sea ice: over 50 percent of the surface was melting during the summer of 2015, contributing to the thirty-sixth consecutive year of global glacier loss.

In contrast to the melting of the massive Greenland ice sheet, the greatest danger for ice loss resulting from warming air and oceans in the Antarctic is the flow of the continental glaciers into the sea. As they reach the sea, “ice shelves” in contact with the water are formed, with the shelves still attached to the ice sheet on land. Melting from below and under tidal forces, these shelves produce the greatest amount of ice loss in Antarctica. As the ice shelves melt and icebergs calve off, more ice flows from the land into the sea. The loss of ice in this most active ice-loss region “shows signs of becoming ‘unstoppable.’ There’s enough water locked up in West Antarctica’s Amundsen Sea region alone to raise the global average sea level by four feet, and it’s the fastest-melting spot on the continent.”[25]

As a result of thermal expansion and melting glaciers and ice sheets, sea levels rose about seven inches during the twentieth century, causing saltwater intrusion to damage low-lying coastal agricultural soils in Bangladesh, the Mekong Delta in Vietnam, and other areas of the world. The sea level is projected to rise another 1 to 4 feet by 2100.[26]

Plastics Are Forever

Plastic production, an essentially post–Second World War industry, increased from less than 2 tons in 1950, to over 340 million tons by 2014.[27] After a single use, 95 percent of all plastic is lost to the production process, escaping into the wider environment: oceans, landfills, or incinerators. Because plastics are synthetic carbon-based polymers that didn't exist on Earth until seventy years ago, few organisms have evolved to be able to metaboliz them.[28] One-third of all plastic is not recaptured, going directly into the environment, often ending up in the ocean (the second-largest percentage goes to landfill). If things continue as they are, in thirty-five years the plastic in the oceans will weigh more than fish.[29]

Needless to say, vast quantities of plastic threaded throughout the watercourses of the world have drastic implications for life of all kinds. In yet another negative ramification for leatherback turtles, plastic bags floating through the oceans look almost exactly like large undulating jellyfish. When plastic bags are ingested, they will often choke the turtles, causing them to be asphyxiated or starve. A study from 2015 estimates that more than half of all turtles and 90 percent of seabirds have ingested plastic.[30] In January 2016 necropsies on twenty-nine beached sperm whales stranded in the North Sea showed the animals had ingested massive quantities of plastic, including, in one case, a 40-foot-long fishing net. Robert Habeck, minister of the environment for Schleswig-Holstein, observed that the animals were made "to starve with full stomachs."[31] Just like those whales, humans who eat fish are almost certainly ingesting chemicals derived from plastic, along with a host of other contaminants.

Estimates vary, but upward of 500 billion plastic bags are manufactured every year, requiring 12 million barrels of oil.[32] Paper bags are no friendlier to the environment: it takes four times as much energy and three times as

much water to make paper bags, producing fifty times more water pollution and about 70 percent more pollution than the manufacture of plastic bags. Millions of trees are cut down that could otherwise be absorbing carbon dioxide; paper is difficult to recycle and takes up more space in landfill.[33] The real answer is not to manufacture any bag designed for a single use (or for that matter, most other products). But because industry is so strongly opposed to that, efforts to ban single-use plastic containers have had limited success.

As plastic is now pervasive throughout the environment and will last so long without degrading, it has been proposed as one way to measure the impact of humans in the Anthropocene:

> Plastics are now widely enough distributed to characterize such strata over large parts of the world, even in remote environments such as that of the deep sea floor and the polar regions. Especially in marine sediments, microplastics form superficially invisible, but potentially widespread markers, directly akin to microfossils in more conventional palaeontology…. Stratigraphically, plastics within sediments comprise a good practical indicator of Anthropocene strata…. Their correlation potential, though, now stretches out into space, as they have now been carried across the solar system by spacecraft, and placed in orbit around the Earth and on the surface of the Moon and Mars.[34]

In other words, not only has a single planet been poisoned—contamination of the whole solar system is occurring. A product with extremely useful and important properties has been produced but maladapted to its most appropriate and least damaging applications, used in short-term ways that cause immense pollution and long-term harm to the biosphere and beyond.

The Scourge of Air Pollution

Considered to be the largest environmental problem to threaten human health, the severe health implications of air pollution are only beginning to be fully quantified.

Energy production and use is the single largest contributor to air pollution. The smoke emitted by indoor sources for cooking, heating, and light (wood, charcoal, kerosene, etc.), which are used by 2.7 billion people, is estimated to be responsible for 3.5 million annual premature deaths.[35]

An estimated 166 million people—over half the U.S. population—live under conditions exposing them, simply by breathing, to high ozone and particulate air pollution.[36] In 2011, air pollution from the U.S. energy industry caused $131 billion in damage, mostly in health impacts.[37] According to a slightly earlier study by the National Academy of Sciences, all 137,000 coal miners in the United States could be given tax-free pensions of $50,000 a year for only 10 percent of the cost of the air pollution generated by the production of energy from burning coal.[38] On a global scale, the economic and health impacts of air pollution are staggering. According to the World Health Organization, the cost in Europe alone comes to almost 10 percent of the combined European Union economy, $1.6 trillion:

> Over 90% of citizens in the Region are exposed to annual levels of outdoor fine particulate matter that are above WHO's air-quality guidelines. This accounted for 482,000 premature deaths in 2012 from heart and respiratory diseases, blood vessel conditions and strokes, and lung cancer. In the same year, indoor air pollution resulted in an additional 117,200 premature deaths, five times more in low- and middle-income countries than in high-income countries.[39]

It's important to bear in mind that Europe is often held up as a model of environmental probity. Yet in 2016, some areas of London exceeded their annual limit for nitrogen dioxide levels within the first week of January. Despite the much-touted imposition of congestion charges and early adoption of bike-sharing programs, as well as air pollution controls dating back to the 1950s, London exhibits levels of nitrogen oxides on a par with Beijing and Shanghai.[40]

The World Health Organization has conducted pollution research in over 2,000 cities across the world. María Neira, head of public health at WHO, comments on the results:

> We have a public health emergency in many countries from pollution. It's dramatic, one of the biggest problems we are facing globally, with horrible future costs to society…. Air pollution leads to chronic diseases which require hospital space. Before we knew that pollution was responsible for diseases like pneumonia and asthma. Now we know that it leads to bloodstream, heart and cardiovascular diseases, too—even dementia. We are storing up problems. These are chronic diseases that require hospital beds. The cost will be enormous.[41]

Health impacts in less developed countries with little or no pollution controls, such as India and China, are even worse. In China alone, 4,000 people die every day from the health impacts of breathing polluted air—close to 1.5 million per year. Worldwide, an estimated 6.5 million people die prematurely each year because of air pollution, "making this the world's fourth-largest threat to human health, behind high blood pressure, dietary risks and smoking."[42]

The number of cars in the world is set to double in fourteen years to over two billion, the vast majority run on fossil fuels. The effect of this increase will completely wipe out any potential gains in fuel efficiency. As a result, climate change and the effects on humans and all other life forms of air pollution, already severe, can only worsen.[43]

William Blake's famous poem "Jerusalem" speaks of "dark Satanic Mills," evoking a time in England of child labor, sixteen-hour days, and rampant, unchecked pollution. But this is no bygone era: the ever-growing capitalist economy that by its nature ignores environmental effects has taken Blake's dark vision global. "This is the first generation in human experience exposed to such high levels of pollution," says María Neira. "In the 19th century pollution was bad, but it was concentrated in just a few places. Now there are huge numbers of people living with high levels of pollution. Nearly 70 percent of people in cities are exposed to pollution above recommended levels."[44]

According to a study in the journal *Nature*, premature deaths from outdoor pollution in Asia amount to 3.3 million people per year, which is more than the combined death toll from malaria and HIV/AIDS.[45] The majority of this pollution is from cooking and home heating using coal,

kerosene, and biomass such as wood and animal dung as energy sources. A simple and entirely possible switch to clean, renewable energy sources would have immediate and immensely positive health impacts for humans and other species. Eliminating or vastly reducing the use of fossil fuel–based private transportation—cars and trucks—through the reorganization of cities and the provision of powered public transportation, could further reduce these impacts.

Race, Class, and the Environment

Coal is the most polluting fossil fuel. It is responsible for giant quantities of nitrogen oxides and sulfur dioxide production in addition to highly toxic heavy metals such as mercury. Studies have shown that the extent of exposure to those pollutants varies with income and race. For example the National Association for the Advancement of Colored People documents this disparity in its report “Coal Blooded”: the average per capita income for people living within three miles of a coal plant is $18,400, significantly less than the national average of $21,587; and those who live near these coal plants are disproportionately people of color.[46] People of color and the poor are much more likely to live next to toxic waste sites than white or middle-class populations, in numbers out of all proportion to their percentage in the local population.[47] A study conducted by researchers at the University of Minnesota found that in the United States people of color typically breathe air that is 38 percent more polluted than the air breathed by whites. The study’s lead researcher, Julian Marshall commented:

> We were quite surprised to find such a large disparity between whites and nonwhites related to air pollution…. Especially the fact that this difference is throughout the U.S., even in cities and states in the Midwest…. The health impacts from the difference in levels between whites and nonwhites found in the study are substantial…. For example, researchers estimate that if nonwhites breathed the lower NO_2 levels experienced by whites, it would prevent 7,000 deaths from heart disease alone among nonwhites each year.[48]

This disparity is not particular to the U.S.; it is a global phenomenon. Since colonial times European countries have outsourced their own pollution, devastating the environments of their colonies. As a result, richer countries make only limited efforts to clean up their local environments of the most egregious and obvious pollutants. Not only do richer countries relocate the most polluting industries to countries in the Global South, they export waste materials to poorer countries and extract large quantities of resources, frequently leaving ecologically devastated zones in their wake. Such practices, along with promotion of changes in land use to provide the wealthy countries with products like palm oil, are forms of ecological imperialism.[49]

About 3.9 million square miles (10 million square kilometers) of forests have been cut down since the last ice age—half since 1945. Yet in this period Europe and the United States have *gained* forest cover, indicating that virtually all of the deforestation in the last seventy years—an area more than twenty times the size of Great Britain—represents deforestation in the Global South, mostly to serve markets for industry and agriculture in the North. Soil chemist Justus Liebig made exactly this point as long ago as 1840, when the leading global colonial power was Great Britain, which "seizes from other countries their conditions of their own fertility…. Vampire-like, it clings to the throat of Europe, one could even say the whole world, sucking its best blood."[50]

Over 90 percent of those dying or displaced due to climate-related disasters are people from the Global South. When climate disasters hit a wealthy country, such as Hurricane Katrina in 2005, which devastated New Orleans and surrounding areas, it is the poor and people of color who suffer most.

In 2015 it was revealed that the drinking water in Flint, Michigan, was contaminated with lead. The citizens of Flint were being systematically poisoned because state-appointed officials changed to an unsafe water source to save money in 2014. When President Obama boasted of laying enough pipeline for oil and gas production to encircle the Earth yet none is laid along the sixty miles that would get get clean water to Flint, the priorities of our current social system are brought into stark relief.

The Social Crisis

The effect of air pollution and lead contamination of water are only part of the huge environmental impacts on people. A wide variety of chemicals cause millions of deaths worldwide from life-threatening and chronic diseases; they also disrupt hormone activity, leading to an array of mental and physical disorders.

Aside from the many environmental impacts, a host of other critical problems face humanity. Approximately one billion people are either routinely hungry or malnourished. Over one billion people across the world, mostly in rural areas, are forced to defecate in the open because they lack sanitation and toilets. Aside from the problems of human health and loss of dignity, the lack of toilets is particularly dangerous for women, who are left vulnerable to attack. Some 2.5 billion people—about one-third of the Earth's population—have little or no sanitation.[51] Close to 700 million have no access to "improved" drinking water. A further two billion people live on less than $2 a day. Billions lack access to needed medicines or regular health care because they cannot afford them. In the United States, tens of millions of people do not have adequate access to good or affordable health care. Hundreds of millions of people in Asia and Africa have little to no regular access to electricity.

The extent of hunger and malnourishment makes it appear that there isn't enough food to go around for the seven billion people on the planet, and the media constantly tell us that we have already, or are about to, run short. But, says Eric Holt-Gimenez, executive director of Food First and the Institute for Food and Development Policy,

> "Hunger is caused by poverty and inequality, not scarcity. For the past two decades, the rate of global food production has increased faster than the rate of global population growth. The world already produces more than 1½ times enough food to feed everyone on the planet. That's enough to feed 10 billion people, the population peak we expect by 2050. But the people making less than $2 a day—most of whom are resource-poor farmers cultivating unviably small plots of land—can't afford to buy this food."[52]

Profit Over Planet: The Priorities of a Sick System

At the same time that huge amounts of poverty, deprivation, and environmental degradation exist, a staggering amount of wealth has been concentrated at the top of society. A mere 8 people have accumulated as much wealth as the combined wealth of the poorest half of the world, some 3.2 billion people and the richest 1% had more wealth than the remaining 99%.[53] The wealthy go to great lengths to hide their riches from sight—and tax. A 2016 Oxfam report estimates that the money stashed away in offshore tax havens is around *$7.6 trillion*. Hiding that amount from government tax collection agencies annually deprives the public of an extra $190 billion that could be spent on cleaning up the environment as well as health care, education, or other urgently needed public services.[54] "As much as 30 percent of all African financial wealth is estimated to be held offshore, costing an estimated $14 billion in lost tax revenues every year," notes the Oxfam report. "This is enough money to pay for healthcare for mothers and children that could save four million children's lives a year and employ enough teachers to get every African child into school."[55]

In 2012, President Obama boasted, "There are politicians who say that if we just drilled more, then gas prices would come down right away. What they don't say is that … America is producing more oil than at any time in the last eight years. We've opened up new areas for exploration. We've quadrupled the number of operating rigs to a record high. We've added enough new oil and gas pipeline to circle the Earth and then some."[56]

Even as the United States was supposedly part of saving the world during the Paris climate talks in December 2015, Obama signed a bill backed by Exxon and the Koch brothers to expedite pipeline construction permits.[57] Similarly, the Obama administration approved over 1,500 offshore fracking permits in the Gulf of Mexico; some were approved even as the BP Deepwater Horizon oil spill raged out of control in 2010.[58]

The routine immorality of how for-profit corporations operate is topped by Exxon, which knew from its own research as far back as the 1980s that its products were the primary cause of climate change. "In the first place, there is general scientific agreement that the most likely manner in which mankind is influencing the global climate is through carbon dioxide release from the burning of fossil fuels," senior company scientist James F. Black

reported to Exxon's management committee at corporate headquarters in 1977. This spurred Exxon to set up a research program to investigate the potential for warming by as much as 18°F (10°C). When the study verified the potential for such warming Exxon curtailed the research and hid its findings.[59] Meanwhile, the corporation poured tens of millions of dollars into the coffers and bank accounts of think tanks and climate change deniers —scientists and politicians who have essentially rejected the company's own research findings and helped to delay political action against climate change by decades.

But as an investigation by *Inside Climate News* of internal documents and interviews reveals, Exxon was far from alone in suppressing this knowledge. The American Petroleum Institute, together with the nation's largest oil companies, ran a task force to monitor and share climate research between 1979 and 1983, indicating that the oil industry as a whole was aware of its possible impact on the world's climate far earlier than previously known. The group's members included senior scientists and engineers from nearly every major U.S. and multinational oil and gas company.[60]

Contrary to regularly made claims that President Obama is engaged in a "war on fossil fuels," his administration could hardly have been friendlier to increased oil production, according to a 2016 *Bloomberg News* article:

> U.S. oil production has surged 82 percent to near-record levels in the past seven years and natural gas is up by nearly one-quarter. Instead of shutting down the hydraulic fracturing process that has unlocked natural gas from dense rock formations, Obama has promoted the fuel as a stepping-stone to a greener, renewable future.
>
> The administration has also permitted drilling in the Arctic Ocean over the objections of environmentalists and opened the door to a new generation of oil and gas drilling in Atlantic waters hugging the East Coast. [Obama] also signed, with reservations, a measure to lift a 40-year-old ban on the export of most U.S. crude.[61]

It was only in the final days of the Obama administration, when confronted with Donald Trump as successor, that the president signed an order prohibiting new oil and gas drilling in large areas of the continental

shelf under government control in the Arctic and Atlantic Oceans. Congress, however, can reverse this order.

Then there are the proposed international trade deals, which completely subvert any hope that governments are serious about addressing the climate crisis. On the international front, the Obama administration was just as busy as his predecessor in promoting corporate interests. In the final year of his presidency Obama hoped to sign the Trans-Pacific Partnership (TPP) and the Trans-Atlantic Trade and Investment Partnership (TTIP). Modeled on the environmentally and socially disastrous 1994 North American Free Trade Agreement (NAFTA), signed into law by another Democrat, Bill Clinton, both deals incorporate language designed to protect against "loss of future profits." Translation? "Under either trade pact, if a new air rule, for instance, creates disincentive for an international energy company to build a coal plant, it can sue the government for investment losses if the company can prove the policy was adopted after initial plans for the plant were made."[62] Both international trade deals appear to be dead in the water as a result of persistent organizing against them and in the wake of Donald Trump's election as president. International trade deals such as NAFTA have little to do with trade and lowering tariff barriers; they are primarily about allowing unhindered capital movement, protecting intellectual property rights, undermining workers' ability to organize and fight for better conditions in the North and the South, and weakening environmental regulations, all of which facilitate corporate profit-taking.

Under these so-called free trade agreements, corporate interests always trump environmental protections. But it doesn't merely end with corporations being able to sue governments; it includes limitations on how environmental issues will be addressed. As reported in the journal *Nature Climate Change*,

> A number of unproven approaches to environmental policies underpin free trade agreements. Among them is the market-based approach to carbon pricing, such as an emissions trading scheme, often considered to be a dysfunctional alternative to stringent industrial standards or carbon taxes. Less direct than a carbon tax, market-based carbon pricing can also be easier to manipulate, as shown by previous experience in Europe.[63]

Taking into account the healthcare costs caused by pollution, the International Monetary Fund estimates subsidies for the production of fossil fuels at $5.3 trillion in 2015, or 6.5 percent of the global GDP.[64] Contrast this with aid to developing countries: the United Nations has spent decades trying to get developed countries to push their contributions up to a mere 0.7 percent of their GDP, only to be continually rebuffed. In 2014, the United States donated $32 billion in overseas aid (much of it tied to the purchase of U.S. products or as loans rather than actual gifts), a miserly 0.19 percent of GDP.[65]

Are There "Green" Alternatives?

Just as we are told that there aren't enough resources to feed everyone or lift people out of poverty, we are told that efficient renewable energy technologies don't exist, or that they would be too expensive to build, or that wind and solar power are unreliable. A 2016 study by the U.S. National Oceanic and Atmospheric Administration shows otherwise: the United States, which is responsible for 25 percent of global greenhouse gas emissions, could "transition to a reliable, low-carbon, electrical generation and transmission system … with commercially available technology and within 15 years."[66]

This would mean an almost 80 percent drop in carbon emissions from 1990 levels by the electricity-generating sector by 2030. This new electrical generation and transmission system would not even require storage because it would be regionally integrated. This is exactly the kind of change required for staying within 3.6°F (2°C) of average global warming. It could be done at less cost than continuing to use fossil fuels to produce electricity. Electrical production currently accounts for two-fifths of U.S. greenhouse gas emissions.

In a world heading rapidly toward irreversible and devastating climate change, not only are renewable sources of electricity the best option; they are the only option if we want reliable electricity. Why? Because thermoelectric power plants, which currently supply 98 percent of global electricity (whether using nuclear, fossil fuel, hydroelectric, or biomass fuel), need massive quantities of water to generate steam for cooling and to

pump power for dams. One study estimates that because of lower water levels and warmer temperatures in many rivers, generating capacity could be reduced "by as much as 86% in thermoelectric and 74% in hydro-electric plants."[67]

Once seen as an ultra-reliable source of "green" power for developing countries, hydroelectricity is showing itself to be anything but. Brazil, a country that produces 75 percent of its electricity from hydropower (for South America as a whole it's 63 percent), suffered extensive blackouts in 2014 owing to a four-decades-long drought.[68] Despite that, the shortsighted, profit-driven priorities of capital mean that Brazil is still building more mega-dams. These dams displace indigenous peoples from their cultural home and way of life and bury rain forests beneath newly created giant lakes; the lake beds—once rain forest, now a mass of rotting vegetation—contribute massive quantities of the climate-warming gas methane to the atmosphere. Despite massive and ongoing protests by workers, farmers, and indigenous groups, the Brazilian government is still attempting to build the ecologically and socially devastating Belo Monte Dam, the third biggest dam in the world.

According to researchers, the most vulnerable areas for shortfalls in electricity due to water reductions and warmer water are "the United States, southern South America, southern Africa, central and southern Europe, Southeast Asia and southern Australia … because declines in mean annual stream flow are projected combined with strong increases in water temperature under changing climate. This reduces the potential for both hydropower and thermoelectric power generation in these regions."[69]

When rain forest is cut down for pastureland or other forms of development, buried under thousands of tons of water behind a dam, and people are displaced from their homes a vital ecosystem linkage is being broken—but it is not the only one. Tropical forests store 40 percent of all terrestrial carbon, and deforestation is a significant contributor (15 percent) to carbon emissions. Hardwood trees, with their thick trunks, giant size, and long lives, are the most significant contributors to that carbon storage mechanism.

A study from São Paolo State University in Brazil analyzed the interactions between 800 animals and 2,000 species of trees, detailing how the changing composition of rain forest trees resulting from the fracturing

of the ecosystem is leading to further problems. “Policies to reduce carbon emissions from tropical countries have primarily focused on deforestation,” notes Carlos Peres, a member of the research team. “But our research shows that a decline in large animal populations poses a serious risk for the maintenance of tropical forest carbon storage.”[70] Because 95 percent of trees indigenous to the rain forest depend on these animals for seed dispersal. It is only large animals, which are the group in the greatest decline—such as tapirs, fruit-eating monkeys, and large birds like toucans—who can eat the big seeds of hardwood trees and disperse them through defecation. This means that even where rain forests survive, they are gradually losing giant hardwood trees, including important food sources like Brazil nut, cacao, and acai trees.

THE EXAMPLES OF THE LEATHERBACK TURTLES and the large rain forest animals serve to underline the interconnectedness of the biosphere. They also demonstrate why only systemic change, making it possible to tackle all of these problems simultaneously and without political constraint, can reverse the damage. Taken together, our ecological and social crises—together forming a single interwoven socioeconomic crisis—provide a damning indictment of our economic, political, and social system and the way it operates.

Conversely, with the exception of extinction events, these crises are eminently reversible—as long as we can remove the root cause: capitalism. This is critically important news. Since these effects are created by human society, they can be undone by a differently oriented society.

*For convenience, we use 200,000 years to refer to the range of 150,000 to 200,000 years ago commonly given for the emergence of anatomically modern humans.

2

The Root of the Social-Ecological Crisis

> A stark choice faces humanity: save the planet and ditch capitalism, or save capitalism and ditch the planet.
>
> —FAWZI IBRAHIM[1]

WE MAINTAIN THAT CAPITALISM, *of necessity*, operates to create our global social-ecological crisis. But before we go into a more detailed explanation of why this is so, let us first briefly examine some of the other explanations for today's crisis that are commonly put forward—overpopulation, innate human greed and destructiveness, a flawed growth paradigm, and bad policy choices.

One of the most common arguments for the crisis is the "population problem": there are just too many people in the world, using too many of the Earth's resources. This is the chief cause of pollution, hunger, resource depletion, and poverty. It is true that the human population has increased greatly over the last few hundred years and that higher populations tend to create more stress in particular locations. Some countries do not have enough agricultural land to feed their people. Many of these countries—for example, Saudi Arabia, the Netherlands, Singapore, and Great Britain—simply purchase food from abroad. Saudi Arabia, the United Arab Emirates, China, and several European countries have even leased or bought outright land in parts of Africa or Ukraine, with its deep and rich but underutilized soil, in order to grow food for their home markets.

Not all countries can afford to purchase additional food when there are widespread crop failures or short supplies and the price of food jumps on the world market. In 2008, such price spikes led to food riots in twenty-

eight countries. Yet at the same time, there were sufficient global food stocks.[2] As one example of what was available during that year when so much suffering occurred, about 30 percent of the enormous U.S. corn crop was converted to ethanol to feed cars instead of people.

It's not overpopulation that's the problem; it's unequal distribution of wealth and resources. Quite simply, people are hungry or starving because they are poor and unable to exert effective demand in the market, which requires money. The wealthiest 10 percent of the global population uses about 60 percent of Earth's resources and is responsible for about the same portion of global pollutants released into the biosphere. The so-called population problem is in reality a wildly skewed social system, with gigantic waste built into the economy and overconsumption by wealthy people.[3] In the United States, working people are constantly blamed for consuming too much, but in fact 38 percent of all consumption in 2012 was by the richest 5 percent.[4]

Ecological havoc is often attributed to human nature: our greedy and destructive instincts cause us try to dominate nature, regardless of the consequences. Although there are certainly examples of past civilizations that have caused lasting local or regional ecological harm, others have tread lightly, surviving and flourishing in ways that allowed land and water to regenerate by developing relatively low-impact agricultural systems. In many cases the practices of humans have resulted in a more biologically diverse local ecosystem than would have been the case otherwise. As historian Neil Roberts observes:

> It is easy to fall into the trap of describing human impact on the natural world solely in terms of 'degradation' and 'impoverishment,' especially when considering issues such as soil erosion or deforestation. In fact, agriculture—at least in its pre-modern form—has generally been an agent of ecological diversification. It caused the relative homogeneity of primeval forest ecosystems to be replaced by a mosaic of … ecosystems, created and maintained by human action, and their fates came to be intimately associated with particular modes of agricultural production.[5]

Ecological damage done by ancient peoples occurred because of class dynamics, low levels of technology, and lack of knowledge of long-term impacts, not because of any ingrained tendency to destroy. Once such damage occurred, many ancient agricultural societies adapted to the changes they had caused or moved elsewhere. In the Mediterranean region they modified their landscapes, building terraces to reduce runoff and erosion; or they raised perennial crops more adapted to hilly land, such as olive trees and vineyards. Wheat, which requires annual soil plowing, was then grown on the more level fields or purchased by selling olive products and wine. Human societies have generally been able to adapt and modify practices as mistakes were made or in the face of environmental change over which they had no control, such as multi-year or multi-decade droughts.[6]

Some people feel that too much growth is the cause of the ecological crisis. We need to move to a zero growth economy, they say, and the way to do that is by changing our "growth paradigm." Instead of focusing on the *gross domestic product* (GDP)—which is the measure of all goods and services produced annually in a country—economists and the media should focus on a *gross national happiness* index, which would measure people's quality of life. Others have likened the perpetual growth of capitalist economies to a societal addiction, requiring therapies to help cure the addiction.[7] But growth paradigms or addictions do not create the system—they are *products* of the system. Simply altering what is measured, how something is described, or undergoing societal therapy will not change the trajectory of an economy.

Other explanations for the ecological crisis tend to be variations of the "growth problem": for example, there are people, sometimes referred to as "neoprimitivists," who believe that industrial society itself is the problem and therefore we should return to a simpler lifestyle, hunting and gathering, presumably with many fewer people. Then there are the "green capitalism" advocates who maintain that people aren't buying the right things—everything would be fine if we all just bought "green" stuff. Some explanations get a little closer to the heart of the matter, pointing to the need for more regulation so that businesses would not be allowed to pollute at will.

But these explanations for the environmental and social problems we face focus on symptoms while ignoring the root cause of the global crisis—the capitalist system. More insidiously, each of these explanations—overpopulation, individual overconsumption, human nature, growth paradigms, value judgments—have something in common: everyone is to blame for the problem. Or, in the words of Pogo the possum (in a poster designed to mark the first Earth Day in 1970), "We have met the enemy and he is us."[8] But if "we" are the problem, this absolves the elite and the economic system from which they benefit.

What Is Capitalism?

In its simplest terms, capitalism is a social and economic system based on private ownership of the means of production (the factories, equipment, land, etc.) for the purpose of making commodities (goods and services) in order to sell them at a profit. Most people have no way to make a living on their own and must work for those who own the land, factories, and other businesses. Business profits derive from the unequal relationship between labor and the owners of capital, with workers paid less than the value they add during the production of commodities. One way that business owners continually try to increase their profits is through greater control and exploitation of their workforce.

Markets, though not a defining feature of the system as some think, are needed in order for sales to occur and profit to be obtained.

A commodity can be as simple as an apple or as complex as a car or a computer made from minerals mined from all over the world. And types of services vary widely: haircuts, hotel accommodations, equipment repair, or heart surgery. The goods and services produced by businesses embody human labor power and natural resources. And though commodities may have a genuine use, their real value in this economic system is that they can be sold *for profit*—for more than the cost of making them.

Position of Labor

Because workers depend upon capitalists for their livelihoods, they are subservient to the owning and managerial classes. One way that business owners continually try to increase their profits is through greater control and exploitation of their workforce. They can do so because of the unequal power relationship between labor and the owners of capital. Individually, workers are not normally able to negotiate their wages, benefits, and working conditions. They gain power relative to capitalists by coming together to form unions, so they can use their collective strength, including the ability to stop work by striking. This is what makes unions so important to workers in capitalist economies. That is why capitalists oppose unions and try to stop their formation, while fostering anti-union sentiment in the general population through their indirect control of the media and politicians.

Whenever their power is weakened, workers are commonly forced to work harder ("do more with less"), any benefits they obtained through previous labor struggles such as paid pensions and healthcare coverage are reduced, eliminated, or have to be exchanged for employer promises not to downsize or move production elsewhere. Their miserly pay increases are not commensurate with increased productivity or increased cost of living.

Conversely, when workers have organized strong unions and incorporate elements of social justice into their demands (such as equal pay for women and defense of immigrants), the pendulum of social power swings toward them. This back and forth battle between how the extra value generated by workers is divided, what proportion goes to the capitalists and what goes to the workers or into government social programs, is a constant struggle between opposing interests. It is this sometimes hidden, sometimes open "class war" that explains why there is always going to be social conflict within capitalism.

The decline in the organizing power and conditions of workers over the last few decades and the resulting difficulties are discussed later in the chapter.

Perpetual Growth

Growth is at the core of the capitalist system. This quest for profits is what keeps the system going, it's the moving and motivating force for investment that propels growth. Karl Marx captured this in a simple formula, M–C–M′, where M is the money, or capital, used to purchase raw materials, machinery, and labor to produce a commodity, C, which is then sold for a price, M′, that includes the costs of production and the profit. Profits are then reinvested in the production of more commodities to be sold for more profit, setting up an endless cycle: M′–C–M″ becomes M″–C–M‴ and so on, ad infinitum.

There is also no such thing as too much profit—more is always striven for. The purpose of production is not to provide people with goods and services; the purpose is to make money. Companies compete with each other for market share in order to maximize profits. If a company fails to expand, its profits suffer and it will eventually be taken over or go bankrupt. There is no such thing as steady-state capitalism: it's either grow or die for individual businesses.

As much as the system tries to propel growth, capitalist economies aren't always growing. Boom-and-bust business cycles are a feature of all capitalist economies.[9] When the market becomes saturated and growth falters or a financial crisis occurs, expansion turns into recession, leading to layoffs, cuts to social programs, hunger, and increased poverty. Governments try to get the economy moving again by lowering interest rates, or spending more money, or creating jobs programs or paying out unemployment benefits. Spending money becomes a public duty to resurrect growth.

The profit motive even applies to essential goods and services such as food, clothing, and healthcare that are clearly in the public's interest. In a June 2014 *Wall Street Journal* article, Mike Peterson, CEO of Valeant Pharmaceuticals, explains that "R&D on average is no longer productive. I think most people accept that. So it is begging for a new model, and that is hopefully what we have come up with." Instead of trying to discover and bring new drugs to market, Valeant has increased profits by purchasing other companies, lowering production costs, and raising drug prices. It relocated its headquarters to Canada and made other changes purely to obtain tax advantages. Peterson goes on: "We were able to get a corporate tax structure which took our effective tax rate from 36 percent over all to

what was actually 3.1 percent, which we hope to continue to work on and move lower."[10]

Another tactic that drug companies use is to combine two inexpensive drugs and market the combination as something special at a huge markup. A box of nine tablets of the drug Treximent, brainchild of the Pernix Therapeutics, costs $728 while its two ingredients cost $19.[11] Other pharmaceutical companies, including Valeant, have also adopted the practice of charging outrageous prices for combinations of inexpensive drugs.

Individual companies and the system as a whole work to maintain growth, through investment in new production, city and state tax breaks for companies, promoting favorable regulations, opposing regulations deemed unfavorable, and working for international agreements that maximize flexibility to move capital and goods across borders.

The Market Needs and Creates Consumers

One of capitalism's central problems is how to sell the avalanche of goods that are continuously churned out by ever more productive factories and workers. This creates the need for never-ending, ever-increasing consumption. So, how does such a system of commodity production, always making new items and more of the old ones, sell all its products at a high enough price to make profits?

It does so by finding and developing new markets in other countries or among new groups of people by inducing in them a "need" for these commodities. Advertising and other types of marketing play an essential role in capitalism, not just to sell a particular product but to convert people to consumption as a way of life, a path to personal happiness, a means of overcoming feelings of emptiness, loneliness, and dissatisfaction that are generated by a system that stresses individualism, competition, and consumerism. An essential purpose of advertising is to make people feel inadequate in their bodies and lifestyles. The "consumer age" didn't happen by accident; it arose as a systemic necessity, carefully cultivated as an ideology supportive of business interests.

As far back as 1955, Victor Lebow proposed the following solution to the problem of overproduction: “Our enormously productive economy demands that we make consumption our way of life, that we convert the buying and use of goods into rituals, that we seek our spiritual satisfactions, our ego satisfactions, in consumption.”[12] But what happens if consumption isn’t great enough? “We’ve got to motivate people to want things so they’ll work for these things,” says marketing guru Philip Kotler. “If there’s no more things they want, they won’t work as hard: they’ll want 35-hour weeks, 30-hour weeks and so on. Yes, marketing does drive us to new wants.”[13] To stimulate new wants, 30,000 to 40,000 new products are coming onto the U.S. marketplace every year.[14]

The increasing concentration of companies in most sectors of the economy increases the need for advertising. According to Robert McChesney, “Modern persuasion advertising blossomed as a function of less competitive markets where a handful of firms dominate output or sales. Advertising emerges front and center as a major way to increase or protect market share without engaging in destructive profit-damaging price competition.”[15] The more similar the product, the more firms must spend on advertising to shape their brand image to emphasize differences, which are based on what the packaging looks like, which demographic it will appeal to, and the feelings and emotions it will generate in the consumer’s life. Of course, the more advertising there is, the more corporations have to advertise to make a potential consumer pay attention to their product.

The Internet has created a new phenomenon: it is now possible for telecommunications companies who provide access and other services to gather personal information from their subscribers and sell it to advertisers. The data they collect provides unique portraits of users’ online habits. The person’s taste, perceived needs, and desires are manipulated to sell more products, faster and more effectively. This amounts to the commodification of a person’s identity.

But where do the people who can afford it put all the stuff they buy? Living in larger houses with three-car garages helps, but it is the storage industry that has really benefitted from overconsumption. The *Wall Street Journal* describes one such company, Public Storage, as “the self-storage giant that on the surface appears boring but in reality has created a fantastic business housing all of the junk that Americans refuse to part with.”[16]

Just as Lebow suggested, people are encouraged to value relationships with things over their interactions with other people. Those things, the commodities that workers produce, dominate people's reality. Navigating this reality becomes the purpose of life. The more things workers produce, the more ensnared and subservient they become to commodities. Marx characterized the phenomenon as "commodity fetishism," finding an analogy in "the mist-enveloped regions of the religious world. In that world the productions of the human brain appear as independent beings endowed with life, and entering into relation both with one another and the human race. So it is in the world of commodities with the products of men's hands."[17]

The deepest issue is not that humans have an obsession with buying commodities, or even that we worship them. It is that we view commodities as if they are living and independent entities that form relationships with each other and with people.

Full Employment Is a Fantasy

"There is no provision that all those able and willing to work will always have a job," observed Albert Einstein. "An 'army of unemployed' almost always exists. The worker is constantly in fear of losing his job."[18] Full employment rarely occurs in capitalist economies. After all, labor is just another commodity. When it's in short supply, workers are able to demand better wages and working conditions, and that's not good for business. The system functions best when there is a pool of workers who are normally excluded from full participation in the system—women, immigrants, and people of color—a reserve army of labor that can be called in when companies need more workers. Having a group of potential workers that can be mobilized if needed keeps a downward pressure on wages of the employed. Effective labor organizing is also undermined by the existence of a group of people always available to fill slots of employed workers.[19]

Workers and unions generally support economic growth because of the promise of the availability of jobs. A continuous supply of new jobs is needed to absorb labor displaced by automation (including robots and the algorithms that operate computers and robots), downsizing, and offshoring.

The Great Recession officially ended in 2009, but since then layoffs and discharges from private-sector jobs in the United States have amounted to around 20 million workers per year.[20] While most workers quickly find new jobs when the economy is healthy, a slowdown in growth makes it harder to replace those jobs that are lost through the normal functioning of the economic system.

Theoretically, a national government could function as the employer of last resort, providing jobs to those unable to find work.[21] But this would go against the interests of capital in having easy-to-hire workers when needed. And it would mean raising taxes to pay for these government jobs, which is also against the interests of corporations as well as the "1 percent" of individual capitalists and other wealthy persons.

Growth of Monopoly Power

The trend within capitalism toward the centralization and concentration of capital into larger and larger units has reached a point where a few giant transnational corporations dominate most sectors of the economy. A handful of corporations—Monsanto, Dow-DuPont, Syngenta, BASF, and Bayer (which is trying to purchase Monsanto for $66 billion)—control over 75 percent of the global commercial seed markets.[22] In 2007, in approximately 40 percent of industries, the four largest companies sold more than half of the goods. The four largest supermarket companies in the United States went from garnering 18 percent of sales in 1992 to 32 percent in 2007. This goes on for industry after industry and sector after sector. By 2014 the revenue of the 200 largest nonfinancial corporations in the United States was over one-third of the total revenue of all such corporations.[23]

In a 2015 article for the *New York Review of Books* titled "Challenging the Oligarchy," economist Paul Krugman wrote:

> It's obvious to the naked eye that our economy consists much more of monopolies and oligopolists than it does of the atomistic, price-taking competitors economists often envision…. There's also statistical evidence for a rising role of monopoly power. Recent work by Jason Furman, chairman of the Council of Economic

> Advisers, and Peter Orszag, former head of the Office of Management and Budget, shows a rising number of firms earning "super-normal" returns—that is, they have persistently high profit rates that don't seem to be diminished by competition.[24]

Monopolies and oligopolies don't compete by cutting prices; they compete primarily through advertising, continually bringing out new versions of a product, and other aspects of the sales effort. Less competition means profits above those normally expected, derived from dominating the particular market. "Today's markets are characterized by the persistence of high monopoly profits," says Joseph Stiglitz, former chief economist for the World Bank.[25] "The real key to capitalist success," says Stiglitz, "is to make sure there won't ever be competition—or at least there won't be competition for a long enough time that one can make a monopoly killing in the meanwhile."[26]

Democracy Not Essential

The United States is a plutocracy; the wealthy elite—or ruling class—controls the government and its regulatory system. "Of the 1%, by the 1%, for the 1%," is the way Stiglitz puts it.[27] Capitalism does not require democracy in order to exist. It has functioned quite happily under dictatorships around the globe: under Franco in Spain, under Pinochet in Chile, and under the military juntas of Brazil and Argentina. Capitalism has thrived in contemporary Saudi Arabia, China, and so on. What capitalism requires is a state that sets rules, facilitates business success, and acts to protect and expand national business interests when domestic corporations operate in foreign countries.

In 2014, political scientists Martin Gilens of Princeton and Benjamin Page of Northwestern University conducted a study confirming that the economic elite, composed of superrich individuals and organizations representing business interests, "have substantial independent impacts on U.S. government policy, while average citizens and mass-based interest groups have little or no independent influence. The results provide substantial support for theories of Economic Elite Domination and for

theories of Biased Pluralism, but not for theories of Majoritarian Electoral Democracy or Majoritarian Pluralism."[28]

In other words, the United States is governed by a plutocracy instead of the democracy that many still believe exists. With Donald Trump as President and Congress and the majority of state governments under Republican Party control, the elite—especially the fossil fuel and financial industries—are becoming even more powerful.

The Rise and Growth of Capitalism

How did capitalism get started in the first place? What were the original sources of capital? How were free workers forced to sell their labor power to the capitalists? And why were colonialism and slavery such an integral part of capitalism's development?

Capitalism requires pools of capital and labor as well as access to natural resources. When all are available, capitalists organize labor and obtain machinery, land, and other resources and put it all in motion to produce commodities. The accumulation of capital that began the process by providing large amounts of money that could be invested was based on theft: stolen labor, stolen people, and stolen natural resources. The colonial powers stole precious metals primarily from the Americas and brought them to Europe. Land was appropriated and indigenous peoples were compelled into forced labor. Millions of men and women were seized as slaves from Africa, decimating that continent while providing labor in its cheapest form to develop the resources of the New World as well as a source of wealth for traders and slave owners. In all of this, the nation-state was the organizing instrument that promoted, planned, and carried out the thefts or gave permission and made the resources available to do so.

While plunder in the colonies and slavery provided capital and labor for further investment, capitalism as it developed its modern form needed laborers in the "home" country to work in the factories. These workers were obtained through the enclosure process. The enclosures of land in Britain occurred over centuries, but accelerated as the British Parliament passed a series of Enclosure Acts, culminating in the nineteenth century. These laws incorporated the portion of land and water that had once been free to all—

the commons—into the vast privately owned agricultural estates. With nowhere to pasture their animals or grow their crops, the peasants were forced off the land and, in order to live, were compelled to sell their labor to the nascent industrial market. In the New World, millions of native peoples were being driven from their homes, enslaved, slaughtered outright, or decimated by smallpox and other diseases for which they had no immunity. European settlers—mostly peasants forced off their land in the home country but not needed in the developing industries—seized their territories and privatized what had been communal resources of water and land.

The massive trade in human beings and later the colonial takeovers changed the economic and social trajectory of whole continents. Slaves were sources of labor and wealth—commodities to be bought and sold, rented out and used as collateral for loans. The labor of enslaved Africans made it possible to develop the sugar and cotton plantations that were so central to capitalist expansion in the Americas. Slavery was also central to providing Britain with massive amounts of raw material for the first mass-produced commodity, cotton textiles.

Because of the significance of cotton and its critical role in the rise of the Industrial Revolution, and the role enslaved labor played in producing cotton and sugar, the importance of slavery to the economic development of the U.S. and Britain cannot be overemphasized. As historian Walter Johnson has written,

> In the years before the Civil War, there was no capitalism without slavery. The two were, in many ways, one and the same…. It is not simply that the labor of enslaved people underwrote 19th-century capitalism. Enslaved people were the capital: four million people worth at least $3 billion in 1860, which was more than all the capital invested in railroads and factories in the United States combined. Seen in this light, the conventional distinction between slavery and capitalism fades into meaninglessness….[29]

By the time of the Civil War, cotton production was 30 percent of the U.S. economy. Cotton became so integral to the economy of the South and the world economy that it was known as “King Cotton,” and during the relatively short period from the 1830s to the U.S. Civil War, “Indian land,

African-American labor, Atlantic finance and British industry [were] synthesized into racial domination, profit and economic development on a national and a global scale."[30]

The invention of the cotton gin to clean raw cotton at the end of the eighteenth century allowed for a huge increase in worker productivity and cost savings in this aspect of the industry. However, as historian Sven Beckert makes clear in *Empire of Cotton*, what really made the difference was not better technology but the social relations unique to capitalism. The explosive growth of the cotton textile industry, Beckert writes,

> did not at first derive from technical advances, nor from organizational advantages, but instead from a far simpler source: the ability and willingness to project capital and power across vast oceans…. The muscle of armed trade enabled the creation of a complex, Eurocentric maritime trade web; the forging of a military-fiscal state allowed for the projection of power into far-flung corners of the world; the invention of financial instruments … allowed for the transfer of capital and goods … the expropriation of land and deportation of Africans created flourishing plantations.[31]

The European countries seized colonies in Asia, Africa, and Latin America. Atrocities were routinely committed by the colonial powers, particularly when people refused to submit. For example, in the German colony in what is today Namibia, tens of thousands of people from the Herero and Nama tribes were slaughtered in what the German government now admits was genocide. Esther Muinjangue, a Herero activist and social worker at the University of Namibia described the enormity of what happened during colonial rule: "We are talking now about the lives that were lost, the land that was taken, the cattle that was killed, the rape, the lost dignity, the culture that was destroyed. We cannot even speak our language."[32]

Former World Bank economist Branko Milanovic described capitalism as:

> brought to the many at the "point of a gun," and many were "globalized" literally kicking and screaming, from Commodore

> Perry's ultimatum which opened Japan, to British and French gunboat diplomacy in Tunisia, Egypt and Zanzibar, to the Opium Wars and gunboats that patrolled Chinese internal waterways. Worst of all, for many millions who were sold in slavery, or who toiled 16 h a day on plantations from Malaya to Brazil that too was globalization. Globalization was not merely accompanied by the worst excesses of colonialism; colonialism was not an accident. On the contrary, globalization was colonialism because it is through being colonies that most of the non-European countries were brought to the global world.[33]

This was the greatest land grab in history. By the beginning of the First World War in 1914, "the colonial powers, their colonies, and their former colonies extended over approximately 85 percent of the earth's surface."[34] Most of the countries in the Americas became independent from the European powers during the eighteenth and nineteenth centuries. However, it was only after the Second World War that long-standing independence struggles were successful among the colonies of Africa and Asia in the face of the brutalities committed by the colonial powers.

Imperialism as Inherent to Capitalism

In the words of Harry Magdoff, "Imperialism is not a matter of choice for a capitalist society; it is the way of life of such a society."[35] Imperialism without colonies is an essential feature of twenty-first-century capitalism, in which control is maintained in other ways. The leading nation-states use political, military, and economic means to force open and expand markets for goods and services, permit investment and the repatriation of profits, set up low-cost production facilities, control resource exploitation on favorable terms, and pursue geopolitical interests—everything possible to enhance their own national profit potential and power.

After the Second World War, the United States—its huge economy unscathed while other capitalist economies were in ruins—replaced Britain as the world's leading imperial power. Since then, the United States has overthrown democratically elected governments and intervened militarily in

dozens of countries to further its own interests. (See chapter 4 for discussion of U.S. actions abroad.)

Following the attacks of September 11, 2001, there were calls for a more muscular and aggressive foreign policy, a "new imperialism."[36] In a 2003 *Wall Street Journal* article, Alan Murray quoted two Brookings Institution authors as saying that "the real debate is not whether to have an empire, but what kind."[37] As the Iraq insurgency against U.S. intervention exploded, a BBC defense correspondent referred to Rudyard Kipling's famous poem, "The White Man's Burden," as an analogy for George W. Bush's new imperialism. The poem begins with the following exhortation:

> *Take up the White Man's burden, Send forth the best ye breed*
> *Go bind your sons to exile, to serve your captives' need;*
> *To wait in heavy harness, On fluttered folk and wild—*
> *Your new-caught, sullen peoples, Half-devil and half-child*.

The correspondent, trying to stiffen the U.S. government's spine, just as Kipling had tried to do with his poem, reminded Washington:

> It should be remembered that more than 100 years ago, the British poet Rudyard Kipling wrote his famous poem—a warning about the responsibilities of empire that was directed not at London but at Washington and its newfound imperial responsibilities in the Philippines. It is not clear if President George W. Bush is a reader of poetry or of Kipling. But Kipling's sentiments are as relevant today as they were when the poem was written in the aftermath of the Spanish-American War.[38]

The United States straddles the globe with its military might. Despite the closure of hundreds of bases in Iraq and Afghanistan during Obama's presidency, the U.S. operates "nearly 800 military bases in more than 70 countries and territories abroad—from giant 'Little Americas' to small radar facilities. Britain, France and Russia, by contrast, have about 30 foreign bases combined."[39]

New York Times columnist Thomas Freidman, a strong supporter of U.S. imperial adventures abroad, observed in the late 1990s in words that still

ring true: “The hidden hand of the market will never work without a hidden fist—McDonald’s cannot flourish without McDonnell Douglas…. And the hidden fist that keeps the world safe for Silicon Valley’s technologies is called the United States Army, Air Force, Navy and Marine Corps.”[40]

Capitalism Today

Capitalism has the same basic features today that it has had since it began a few centuries ago. It has expanded to nearly every corner of the globe and into every aspect of our lives. The profit motive reigns supreme as the motivating force that propels the economy. Naturally, as the system matures and nation-states rise and fall, significant changes have occurred since the 1970s.

Growth Slows

Economic growth has slowed in the wealthy capitalist nations of Europe, Japan, and the United States. For example, the U.S. annual real GDP growth rate, corrected for inflation, averaged 4.3 percent in the 1950s and ’60s, 3.2 percent in the ’70s, ’80s, and ’90s, and 1.8 percent from 2000 to the middle of 2016.

Increasing productivity and the addition of more factories, stores, and equipment during flush times has resulted in huge overcapacity of industrial capacity and retail outlets and in relation to what can be profitably marketed. In December 2016, seven and a half years after the Great Recession was declared over, only 75 percent of U.S. industry capacity was being utilized.[41] And though the shopping malls serving the wealthy are still doing well today, those serving the rest of the population are struggling. Between 2010 and 2015, about two dozen “dead malls” closed in the United States; another sixty or so are on the brink of failure, and many more are in serious trouble.[42] Global overcapacity in many economic sectors is one factor slowing economic growth.

In 2016, a trend of slow growth, what some economists call “secular stagnation,” has taken over much of the world. In Japan, Europe, and the United States, growth is occurring at rates far below what is possible.

China’s growth, relatively high in comparison to other countries, has slowed considerably. Global trade hasn’t increased in close to two years, leading to an overcapacity in the shipping industry and to the 2016 bankruptcy of one of the major ocean shipping companies, the South Korean–owned Hanjin Shipping. Investment in new productive capacity has declined, threatening future growth. International corporations are sitting on trillions of dollars. Zheng Zhe, chairman of Gulifa Group, a manufacturing company in eastern China, said, “I don’t know what to invest. It worries me a lot…. A lot of industries that we used to put money in have seen tremendous drop in returns. I dare not invest anymore.”[43] This is precisely the problem that many corporations face, so they use a large portion to buy back their own stock, buy other companies, or pay out more dividends instead of investing in future production capabilities.

Neoliberal Policies and Consequences

In response to the return of slow economic growth in the 1970s, capitalists launched a multifaceted effort to enhance their economic and political power, moving toward implementing laws and practices that are collectively referred to as neoliberalism and harken back to earlier periods such as the 1920s. The essential goal of this effort has been freeing capital from as many restraints as possible, resulting in a massive transfer of wealth and power from the public to the private sector. Public services and facilities have been privatized, industry deregulated, unions attacked, tax rates for corporations and the wealthy cut, and social spending slashed, in the name of flexibility and “austerity.”

Neoliberalism does not represent a break from the underlying dynamics of capitalism. It is merely an aggressive response by capitalists, reasserting their interests in the face of social programs they don’t want to pay for, loss of power to labor unions, and the crisis of low profitability. In the United States, an opening salvo in a heightened class war was the 1971 Lewis Powell memo to members of the U.S. Chamber of Commerce that only came to light after Powell’s appointment to the Supreme Court by Nixon. Powell maintained that it was no longer enough for corporations merely to secure profits: “If our system is to survive, top management must be equally

concerned with protecting and preserving the system itself." Saving the free enterprise system required "the scale of financing available only through joint effort, and in the political power available only through united action and national organizations."[44] The memo

> inspired the establishment of the powerful Business Roundtable (which has only CEOs as members), the American Legislative Exchange Council, the Heritage Foundation, the Cato Institute, and Citizens for a Sound Economy (the forerunner of Americans for Prosperity). Within a decade the number of firms with lobbyists expanded by almost fifteen-fold. Corporate PACs quadrupled in number between 1976 and the mid-1980s.[45]

The massive amounts of money in politics, the notorious "revolving door" between government and business, the cozy relationship between corporations and the government agencies that regulate them, tax cuts for the rich and big business, international "free trade" agreements such as NAFTA and the WTO that favor business interests over those of workers—all point to the enormous influence of business on government.[46]

As part of the offensive against labor, unions were blamed for unemployment and economic crises because their workers were too well paid, too secure in their jobs, or had too many benefits. Attacks on wages, benefits, and labor rights were justified by the supposed need for increased "flexibility" in the marketplace. The result has been a decline in union membership in the United States from about one-third of all workers a half-century ago to about 10 percent today (with less than 7 percent in private businesses). The attack on labor went hand in hand with an ideological and political offensive to roll back the social gains of the 1960s and 1970s made by African Americans, women, environmentalists, and other social groups.

With the combined effects of technological changes, slow growth in traditional full-time employment, and greater power of business owners to determine the conditions of work, more people are working in what is called the "gig-economy." It's estimated that one-third of U.S. workers are employed in jobs that pay no benefits, offer no security, may have irregular hours, and have few legal protections. About 70 percent of these workers "report being stiffed at one time or another."[47] While some consider the U.S.

to be near full employment in early 2017, an estimated 20 million people have been left behind, "looking for work, out of the labor force but unhappy about it, or report working part-time when they'd prefer more hours."[48] (The situation for workers in Europe is also difficult, with the unemployment rate about double that in the United States and half of the workers in jobs created from 2010 through 2016 on temporary contracts.[49])

When asked whether class war existed, billionaire investor Warren Buffett said: "There's class warfare, all right, but it's my class, the rich class, that's making war, and we're winning."[50]

Explosion of Debt and Speculation

One of the prominent features of contemporary capitalism has been growth of the financial portion of the economy. As it became more difficult to profit by making and selling commodities, capital began to flow to the financial system; banks and non-bank lenders, investment companies, and insurance companies. Why not just make money without actually making a commodity? As commodity production (M–C–M′) became financial wizardry (M–M′), an expansion of debt and an orgy of speculation followed. With real wages falling, much of the growth of the economy in the developed countries during the last forty years was accomplished through debt expansion, allowing people and companies to spend much more than they actually have: total debt in the United States (government, household, and business) swelled to around 150 percent of GDP in the mid-1980s and reached a peak of over 360 percent of GDP during the Great Recession (2007–2009). There has been an explosion of easy credit—for automobiles, home mortgages, college education, and credit cards that can buy anything—greatly expanding consumption and thereby stimulating the economy.[51]

The sheer magnitude of speculation and accumulated debt and the size of the housing bubble that occurred leading up to the Great Recession were staggering.[52] A good portion of the financial system was converted into a giant casino where bets could be made on just about anything, such as changes in relative currency values, the price of corn, oil, or interest rates at some time in the future, or concocted financial "instruments" so complex

no one really understood them. Though there has been a retreat in total debt in the United States relative to GDP (standing at about 330 percent in mid-2016), total debt of the major economies as a whole has continued to grow since 2009. According to a 2016 article in the *Financial Times*: "Since 2008, total public and private debt in major economies has increased by over $60tn to more than $200tn, about 300 per cent of global gross domestic product (GDP), an increase of more than 20 percentage points."[53]

The importance of debt is that it allows a person or company or government to buy and do things that they would otherwise not be able to do, thereby stimulating the economic activity. But, though there is no firm boundary of how much debt there can be in an economy, the system becomes increasingly fragile as debt increases relative to the underlying economy (GDP). And personal debt can grow relative to one's income until it reaches a level where it becomes increasingly difficult to pay the money back. That's what happened to many households in the lead-up to the Great Recession of 2007–2009. Although the very rapid growth that occurred in China during the first fifteen years of the twenty-first century was certainly impressive, much was based on economic activity stimulated by borrowing by individuals, local and regional governments, and commercial enterprises. Many are now concerned that the debt and asset bubbles in everything from housing to stocks to raw materials (stimulated by massive amounts of debt) cannot be sustained and that difficulties lie ahead for China's economy, with potential global repercussions.

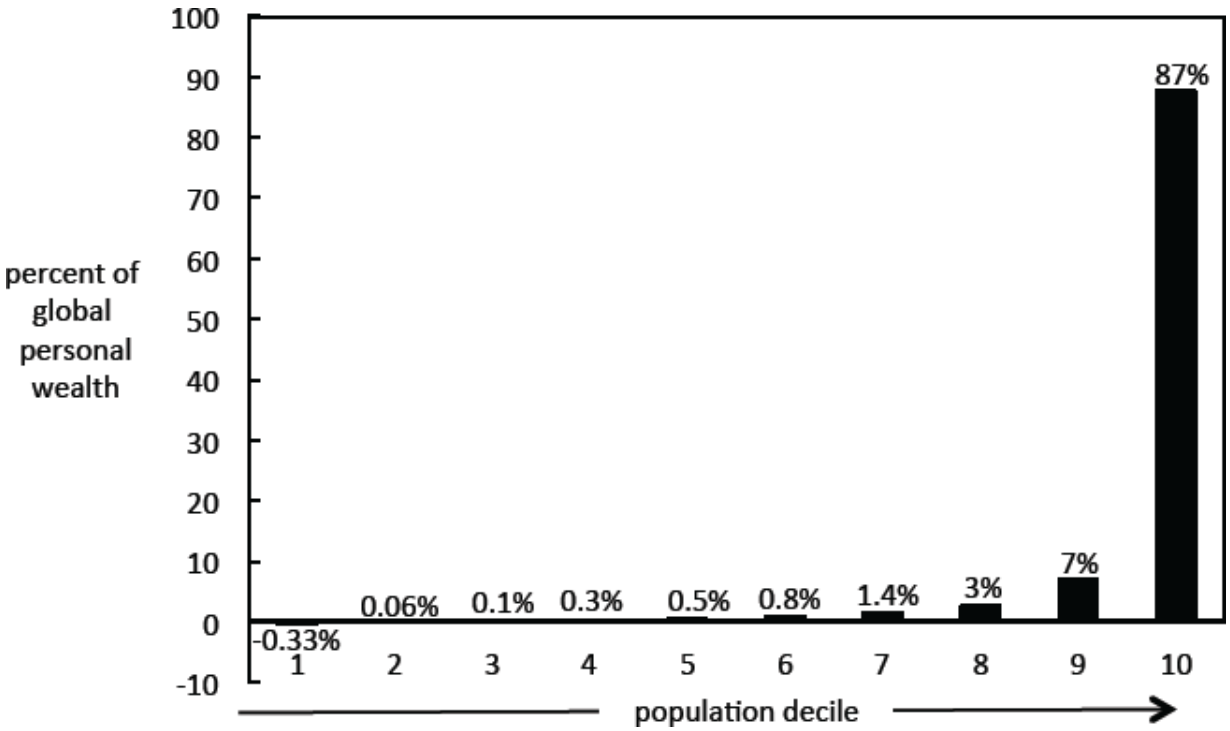
Speculation occurs on an international scale, with literally trillions of dollars sloshing around the world, seeking higher returns first in the poorer ("developing") countries and then in the wealthier ones, depending on relative interest rates and currency values. This is how financial instability is exported, with crises developing when vast quantities of money quickly move out of a country as investors and speculators seek safety and/or higher returns.

More Wealth, More Inequality

Neoliberal economic and political policies and the growth of the financial industry have dramatically increased inequality in many countries of the

world, including the United States. In 2015, total global wealth was $250 trillion—over three times the total global GDP of $73 trillion (2014).[54] But 10 percent of the population owned 87 percent of that wealth (see Figure 2.1) and the richest 1 percent owned half. Conversely, 70 percent of the population owned less than 3 percent of global wealth.[55]

Figure 2.1 Percent of total global wealth ownership by decile (10 percent portions of the population).



Source: Credit Suisse Global Wealth Databook 2015.

Income distribution, though very unequal, tends to be less so than wealth ownership. Income inequality decreased during the Great Depression, and again in the 1950s and 1960s, when many workers were members of strong unions that helped obtain significant wage increases. But that didn't last: in the mid-2010s, the top 10 percent in the United States received about half of all income—a share last seen in the 1920s. At the same time, the top 1 percent increased their income share from around 10 percent to over 20 percent of all income.[56] During nearly four decades, through 2015, as income of the rich and its portion of total income was

skyrocketing, the adjusted income of the bottom half of the U.S. population actually declined by 1 percent.[57]

In the United States inequality by race is even greater, with white homeownership rates at about 72 percent whereas only 42 percent of African Americans owned their own homes. The median wealth of African American households is only about 8 percent that of white households.[58] And of course women still earn only 78 cents for every dollar earned by men in similar jobs and suffer a host of other problems in a society organized to perpetuate gender inequality.

The vast inequalities experienced by large portions of the world's people are not a result of fate, or technological change, automation, population growth, lack of education, or any of the other random factors trotted out to explain income and wealth inequality. Economic inequality is a reflection of the inequality of power between workers and capital built into the system. In its pursuit of perpetual profits and growth, capitalism guarantees that incredible amounts of wealth flow to a small portion of the population while the poor and near-poor are deprived of the resources needed to live full lives. Capitalism has no mechanism to rationally manage the human interaction with resources or promote the general social well-being.

Some of the harmful social effects today result from capitalism's history of slavery and colonization, land theft and marginalization of native peoples, and imperialist interventions. Decades of stagnant or falling wages, increased pressure on the job to do more with less, and more insecure, temporary, and part-time work have also taken their toll on working people in many countries.[59]

Part of the explanation for the election of Donald Trump as President of the United States and the UK's decision to "Brexit" the European Union occurring at the same historic moment is that a significant portion of the working class in these countries justifiably feels that their economic situation is stagnant or getting worse while others enrich themselves. They are aware that this system is unfair with very unbalanced wealth and power. However, not understanding the causes of their predicament, and in the face of showmanship and propaganda playing to their fears, many end up voting for people who will make the situation even more unjust.

At the same time as challenges to neoliberal orthodoxy are occurring, the declining power of the United States to control or even greatly influence events around the world introduces another level of global instability. There is significant dissatisfaction and anger in the European Union with neoliberal policies adopted by center-left governments, with questions arising about more countries withdrawing from the European Union or dropping use of the euro. Across the world people are struggling against the declining quality of life.

The primacy of private profits, a result of the basic way capitalism functions, creates social and ecological dislocation and degradation all around us. The next two chapters explore the consequences of this economic system for the environment and humanity.

3

Capitalism versus the Biosphere

> As long as the individual manufacturer or merchant sells a manufactured or purchased commodity with the usual coveted profit, he is satisfied and does not concern himself with what afterwards becomes of the commodity and its purchasers. The same thing applies to the natural effects of the same actions.
>
> —Frederick Engels[1]

The development of industrial capitalism in late eighteenth-century England resulted in air and water pollution and degraded soil. Marx and Engels followed the scientific studies and political literature and concluded that negative social and ecological side effects of capitalism, today commonly referred to as "externalities," are unintentional, but are nevertheless logical outcomes of a competitive economic system predicated on profit maximization. Engels gives this example:

> What cared the Spanish planters in Cuba, who burned down forests on the slopes of the mountains and obtained from the ashes sufficient fertiliser for one generation of very highly profitable coffee trees—what cared they that the heavy tropical rainfall afterwards washed away the unprotected upper stratum of the soil, leaving behind only bare rock! In relation to nature, as to society, the present mode of production is predominantly concerned only about the immediate, the most tangible result; and then surprise is expressed that the more remote effects of actions directed to this end turn out to be quite different, are mostly quite the opposite in character.[2]

The concept of metabolic interactions between humans and the environment was used as framework to help explain what was happening. In biology, “metabolism” refers to the basic chemical processes that occur within cells and organisms, which require an exchange of materials with the outside environment. For example, we need to eat, drink water, and breathe air to get oxygen into our bodies but we also return materials to the environment in our solid and liquid waste and when we exhale CO_2-enriched air. Marx extended the concept of metabolism to refer to all human interactions with the environment: as we go about making clothes, building houses, factories, and machinery, drilling for oil, producing food, and so on. He argued that when capitalists followed their singular goal of making money, some of these interactions created disturbance so great that they caused irreparable rifts “in the interdependent process of social metabolism, a metabolism prescribed by the natural laws of life itself.”[3]

Why do metabolic rifts and disturbances happen? A fundamental assumption of capitalist economics is that there are unlimited sources of natural resources and unlimited “sinks” to absorb the pollution associated with the production, distribution, use, and disposal of products. Environmental and social considerations play only a small role (if any) when making decisions on production and distribution because the overriding goal is to make the highest profit. Thus, “externalities,” the negative side effects of profit-driven production decisions, are inevitable. As new, larger tools and technologies are developed to increase production and more energy is required to run them, damage to nature occurs more frequently and with much longer-term impacts. Individual capitalists (and the system as a whole) are unable to rationally manage human interaction with the rest of the natural world in ways that preserve the integrity and healthy functioning of the biosphere. It is this reality that leads to severe ecological disturbances and rifts, in the natural cycles and processes on which we and other species depend.

The Great Acceleration

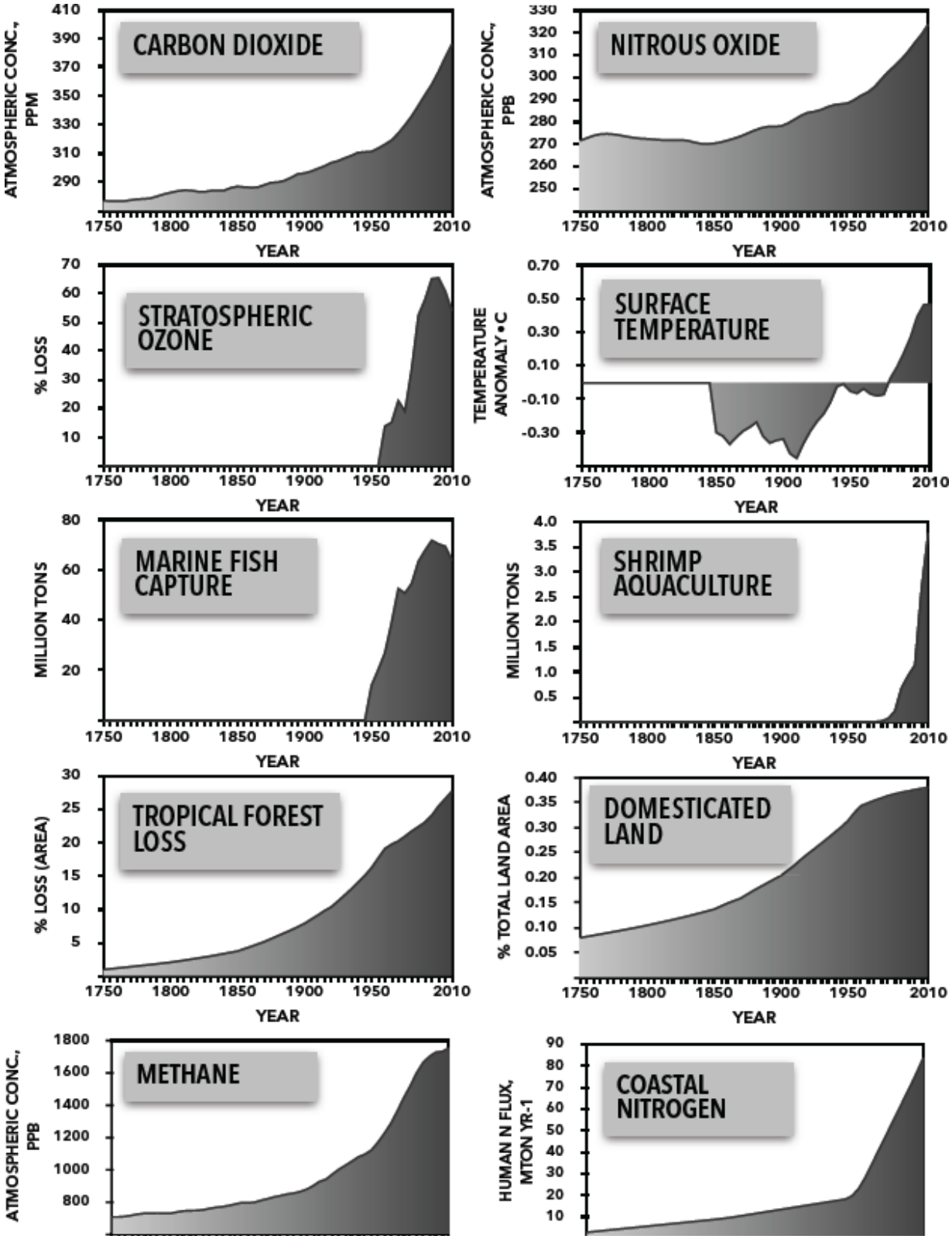
The United States economy experienced a boom following the Second World War when the productive capacity built for the war effort was

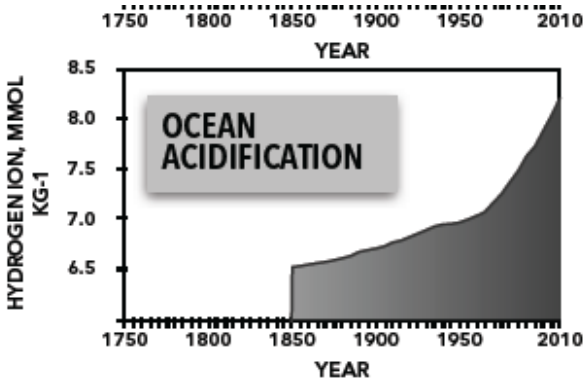
repurposed to fulfill the increased demand for domestic commodities resulting from savings built up during wartime austerity and to rebuild war-torn economies abroad. The economy was also greatly stimulated by governmental programs such as the GI Bill, helping war veterans go to college and buy houses with zero down payments, and a huge burst from the increased production and use of automobiles. The building of the vast interstate national system of highways, begun under President Eisenhower in the mid-1950s, led to the growth of suburbs and stimulated new businesses such as restaurants and hotels and gas stations to service highway travelers and stores for the new suburban population. This is period also marks the beginning of the effort to turn the U.S. public into voracious consumers. From the 1950s to the mid-1970s, economic activity more than doubled in the United States, Britain, and Japan and increased rapidly in other already developed countries.

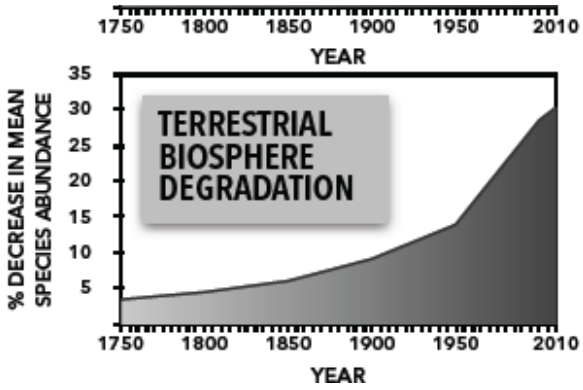
The dramatic expansion of the capitalist system during this period reoriented relations in much of the world toward commodity production of all manner of goods and materials. Global trade increased exponentially, as did energy use, world population, and the global economy as a whole. Production of new and old materials took off: global production of synthetic pesticides went from about one-tenth of a ton in 1945 to about 3 million tons in 1980; plastics jumped from around 2 million tons in 1950 to 52 million tons in 1976, 109 million tons in 1989, and over 300 million tons in 2015.[4] The Working Group on the Anthropocene, a committee of the International Union of Geological Sciences, has dated the start of the proposed new geological epoch to the post–World War II period, with its "Great Acceleration" of economic activity and resultant damage to the metabolic interactions needed to maintain healthy and fully functioning ecosystems (see Figure 3.1, pages 78–79).

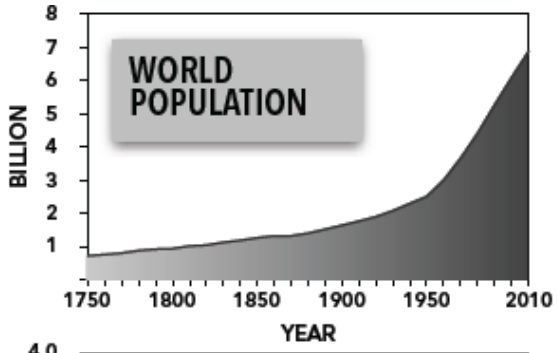
In capitalism, critical economic decisions are often far removed from where the primary effects will be felt and without input from those who will be directly affected. This makes it especially difficult to fully grasp and combat the extent of environmental degradation. Mark Campanale, founder of the Carbon Tracker Initiative and "sustainable investment analyst" of multibillion-dollar projects, illustrates this when describing a meeting "typical of those which happen every day in the City of London":

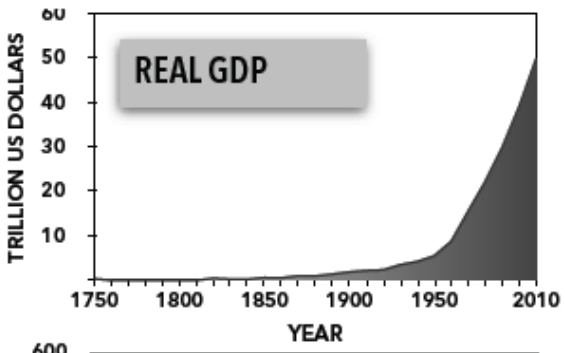
Figure 3.1: Social-Economic and Ecological Trends and the "Great Acceleration."

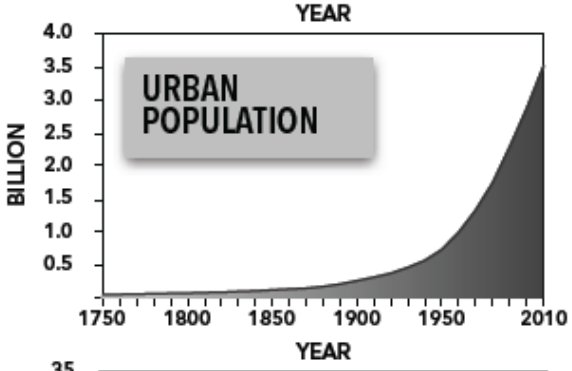


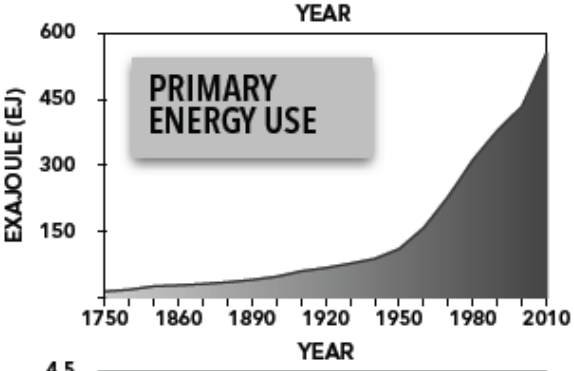

OCEAN ACIDIFICATION
HYDROGEN ION, MMOL KG-1
8.5
8.0
7.5
7.0
6.5
1750 1800 1850 1900 1950 2010
YEAR

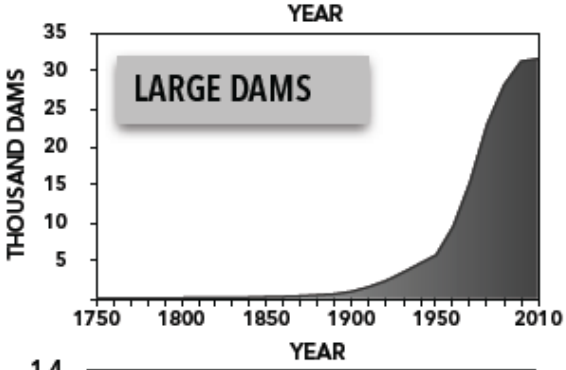

TERRESTRIAL BIOSPHERE DEGRADATION
% DECREASE IN MEAN SPECIES ABUNDANCE
35
30
25
20
15
10
5
1750 1800 1850 1900 1950 2010
YEAR

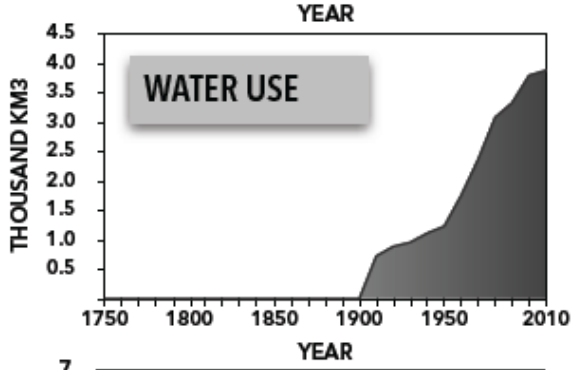

WORLD POPULATION
BILLION
8
7
6
5
4
3
2
1
1750 1800 1850 1900 1950 2010
YEAR

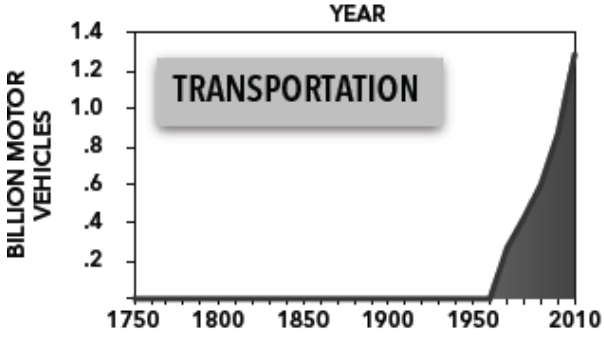

REAL GDP
TRILLION US DOLLARS
60
50
40
30
20
10
1750 1800 1850 1900 1950 2010
YEAR

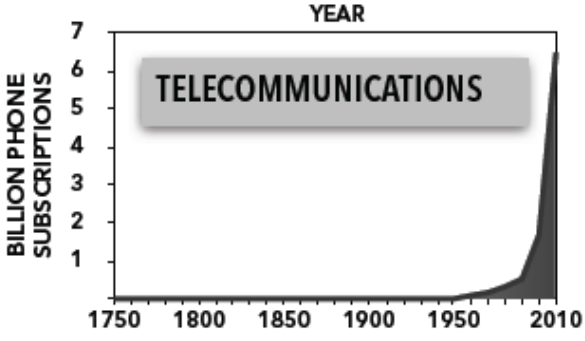

URBAN POPULATION
BILLION
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
1750 1800 1850 1900 1950 2010
YEAR

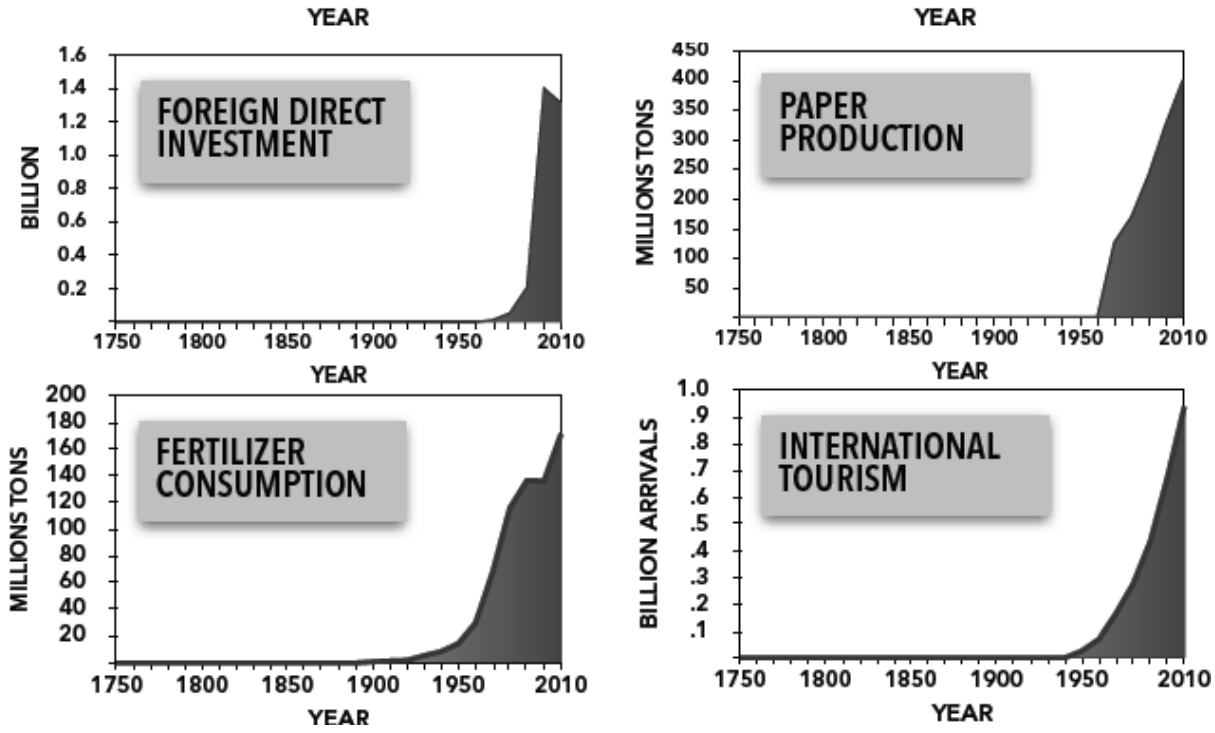

PRIMARY ENERGY USE
EXAJOULE (EJ)
600
450
300
150
1750 1860 1890 1920 1950 1980 2010
YEAR


LARGE DAMS
THOUSAND DAMS
35
30
25
20
15
10
5
1750 1800 1850 1900 1950 2010
YEAR


WATER USE
THOUSAND KM3
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
1750 1800 1850 1900 1950 2010
YEAR


TRANSPORTATION
BILLION MOTOR VEHICLES
1.4
1.2
1.0
.8
.6
.4
.2
1750 1800 1850 1900 1950 2010


TELECOMMUNICATIONS
BILLION PHONE SUBSCRIPTIONS
7
6
5
4
3
2
1
1750 1800 1850 1900 1950 2010



Source: Graphs created by R. Jamil Jonna based on data in Steffen et al., "Trajectory of the Anthropocene," 81–98.

> A group of Indonesian businessmen organized a lunch to raise £300 million to finance the clearing of a rain forest and the construction of a pulp paper plant. What struck me was how financial rationalism often overcomes common sense; that profit itself is a good thing whatever the activity, whenever the occasion. What happened to the Indonesian rain forest was dependent upon financial decisions made over lunch that day. The financial benefits would come to the institutions in London, Paris, or New York. Very little, if any, would go to the local people…. The rain forest may be geographically located in the Far East, but financially it might as well be located in London's Square Mile.[5]

Accelerating changes in our metabolism with the biosphere, generated by the activity of our economic system, have created deep ecological disturbances and rifts, resulting in the global environmental crisis we now face. But even when these disturbances are recognized, after-the-fact attempts to fix the situation frequently go on to cause their own unforeseen negative effects, creating even larger problems.

Nutrient Cycles

In ecosystems relatively undisturbed by human activity such as remote forests and grasslands, the flow of matter and energy tends to remain in a dynamic but relatively stable equilibrium. Essential nutrients such as phosphorus and calcium cycle through this healthy ecosystem with very small amounts lost. Nutrients, though removed from the soil by plants, are maintained within the local ecosystem by their return as animals die and plants shed their leaves or die and decompose. A variety of microorganisms can make nitrogen available to plants and help make the elements in minerals and organic matter soluble and thus usable by plants.

Traditional hunting-gathering communities had relatively small impacts on the cycling of nutrients, not that different from those of other hominid species. Beginning around 10,000 years ago, the invention of agriculture in several locations led to increases in the size and mobility of populations. Many communities depended on slash-and-burn, or swidden farming, whereby if the fallow is sufficient to allow strong regrowth of forests, nutrients naturally accumulated in the vegetation and in the residues on the forest floor. By the time these patches went through another cycle of cutting and burning, sufficient nutrients accumulated to grow crops for two or three years. In ancient civilizations such as those in Mesopotamia and Egypt, with agriculture based on the inundation of soils near rivers by annual flooding, sufficient nutrients were added with the sediments that arrived with the water to replenish the soil. While soil fertility was maintained without much additional effort in slash-and-burn and flood-based farming, other long-term farming systems found ways to perpetuate fertile soils such as using lake or pond sediments as soil amendments or rotations with clovers that enriched soil with nitrogen.

With the growth of industrial capitalism centuries later, agricultural land was put into permanent production. As we described in the last chapter, a large proportion of the population was forcibly removed from the agricultural land and migrated to cities to find work. This created a growing rift in nutrient cycling: most of the nutrients from the soil, transported to cities in the form of foodstuffs, were not returned to the fields. As early as the mid-nineteenth century, Karl Marx described the consequences of such a rift in nutrient cycling:

> Capitalist production, by collecting the population in great centers, and causing an ever increasing preponderance of town population … disturbs the circulation of matter between man and the soil, i.e., prevents the return to the soil of its elements consumed by man in the form of food and clothing; it therefore violates the conditions necessary to lasting fertility of the soil.[6]

Some seventy years after Marx published *Capital*, U.S. Secretary of Agriculture Henry Wallace wrote that society was pouring "fertility year after year into the cities, which in turn pour what they do not use into rivers and the ocean."[7] This was the first large-scale nutrient cycle rift.

A second rift in the cycling of nutrients developed in the mid-to-late twentieth century. With farm animals raised on large industrial farms far removed from the land that produced their food, crop soils lost large quantities of nutrients that were never replenished with manure. Thus farm products for both human consumption and animal feed, containing large quantities of nutrients removed from soils, are transported long distances from croplands to cities and factory farms. (See Figure 3.2.)

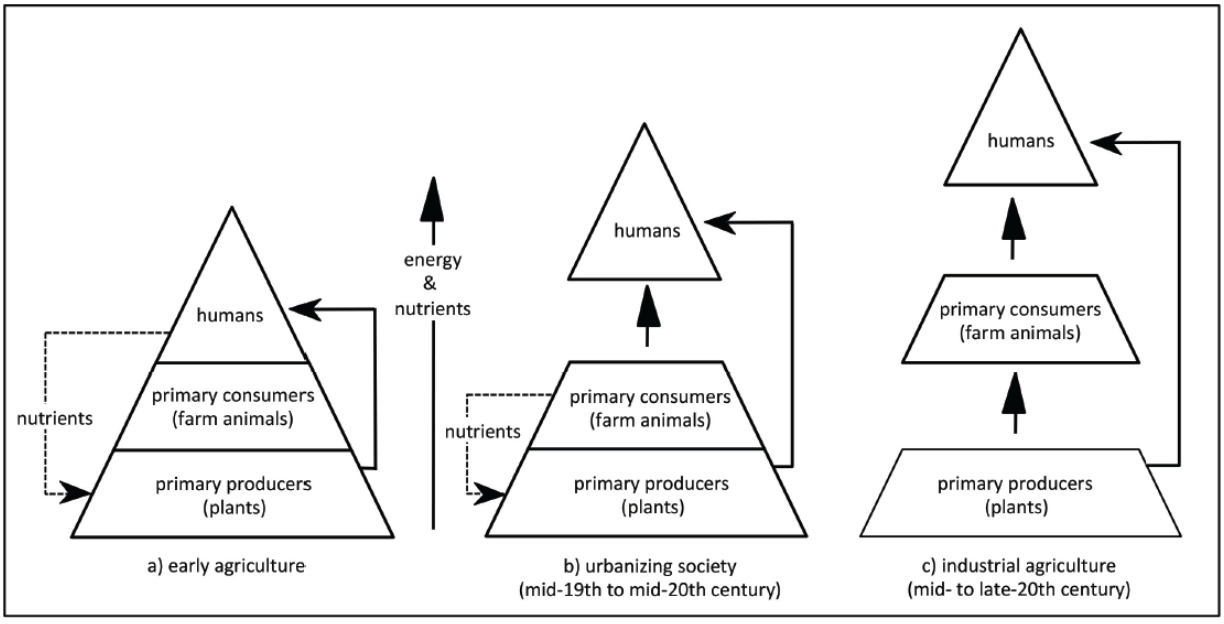
These rifts in the cycling of nutrients have led to the impoverishment of soils, while in cities huge quantities of nutrients accumulate as waste and sewage and as manure on factory farms. Simultaneously, the massive amounts of synthetic fertilizers that are brought in to replace the lost nutrients leach into groundwater and run off into lakes and rivers. This causes water eutrophication: huge algal blooms that deplete the oxygen when they decompose, creating giant low oxygen zones where rivers enter the ocean.

Most pronounced in the United States, the shift to raising beef cows in large feedlots was based on feeding them diets high in corn and soy to fatten them more quickly, shortening the time needed to get them to marketable weight so as to increase profits. But this means that less land is devoted to growing perennial crops for pasture or hay, once the near-exclusive diet of domestic ruminant farm animals. For a year or two following a productive legume or grass-legume hay crop, all the needed nitrogen for grains or vegetables can come from nitrogen stored in soil. Without legume forage crops in rotation, nitrogen fertilizers must be applied annually to supply that key nutrient to grow grains. Less land covered in

perennial crops leads to an increase in other problems, such as accelerated runoff of rainfall and soil erosion.

The development and extensive use of synthetic fertilizers was a capitalist attempt to work around the massive loss of nutrients from agricultural soils. Most of the human waste in the cities of the developed world is chemically and biologically treated in sewage treatment plants, ensuring that relatively clean water is discharged back into rivers and oceans. It is estimated that half of the treated sewage sludge (referred to as "biosolids") in the United States is used for landscaping and on farmland; the remainder is consigned to landfills. Farm fields are the logical destination for the nutrients in human sludge. However, use of sludge on farmlands is a highly questionable practice unless stringent actions are taken to reduce the potential toxic heavy metals and organic chemicals from industry and services such as healthcare (with its use of radioactive test materials), and the chemicals in household products before it is applied to soils.

Figure 3.2: Nutrient and Engergy Flows during Different Eras



Source: Modified from Fred Magdoff, Les Lanyon and Bill Liebhardt, "Nutrient Cycling, Transformation and Flows: Implications for a More Sustainable Agriculture," *Advances in Agronomy* 60:1–73 (1997).

The “solutions” to the rupture of nutrient cycling result in their own problems. For example, the large quantity of fertilizer needed to replace the exported nutrients requires a lot of energy to manufacture (especially to produce nitrogen fertilizer) and damage to land and water occurs as phosphorus is mined and refined. With respect to phosphate, its continual application to agricultural soils is not possible indefinitely. By the end of the century, the currently known high-grade phosphorus deposits may be depleted.[8]

Use of inadequate rotations—either no rotation for a number of years or alternating between corn and soybeans—results in lower yields than would have occurred if the crops had been grown as part of the more complex rotation needed when farm animals and crops are raised on the same farm. Only about half of the applied nitrogen fertilizer is actually used by corn plants. A lot of excess fertilizer, therefore, remains in the soil at the end of the season, and much of it can leach out, causing stream and river pollution with nitrate (NO_3^-). According to the Environmental Protection Agency, “Forty-six percent of the nation’s river and stream length has high levels of phosphorus, and 41 percent has high levels of nitrogen…. Poor biological condition (for macroinvertebrates) is almost twice as likely in rivers and streams with high levels of phosphorus or nitrogen.”[9] Although urban sewage systems and storm runoff make significant contributions, agricultural production is responsible for a huge proportion of nitrogen and phosphorus water pollution. Excess use of nitrogen fertilizer has an additional effect, causing an increase in release of nitrous oxide (N_2O) into the atmosphere. N_2O is a powerful greenhouse gas as well as the leading cause of depletion of stratospheric ozone (O_3), which protects the Earth’s surface from UV radiation.

The magnitude of nitrate losses from cropland in the U.S. Midwest is staggering. The U.S. Geological Survey’s Van Meter continuous monitoring station—in the Raccoon River just upriver from Des Moines, Iowa—samples river flow and nitrate concentrations at fifteen-minute intervals around the clock. Over the span of a year, from April 1, 2015, to March 31, 2016, approximately 100 million pounds of nitrogen (as nitrate and nitrite) flowed down the river on its way to the Mississippi River and the Gulf of Mexico.[10]

A third rift in nutrient cycling occurred with the drastic reduction in populations of sea birds and large land and sea animals. Migratory herbivores once moved huge amounts of nutrients long distances on grasslands; sea birds and anadromous fish (that live most of their lives in the ocean but return to their home rivers to spawn such as salmon and smelt) carried nutrients from sea to land and whales brought them from the deep ocean to surface waters.

Though extinctions of mammoths and other megafauna happened in precapitalist times, much of the damage to populations of remaining large land and sea animals occurred very recently under the pressures of capitalist resource extraction and land use changes. With regard to the oceans, researchers estimate:

> For phosphorus (P), a key nutrient, upward movement in the ocean by marine mammals is about 23% of its former capacity (previously about 340 million kg of P per year). Movements by seabirds and anadromous fish provide important transfer of nutrients from the sea to land, totalling ~150 million kg of P per year globally in the past, a transfer that has declined to less than 4% of this value as a result of the decimation of seabird colonies and anadromous fish populations.[11]

Three rifts in the natural cycling and flow of nutrients have opened as a result of the functioning of capitalist economies. Trying to remedy the consequences of the first two of these has led to other serious ecological problems. (There has been no attempt to deal with the third rift.)

The Carbon Cycle

The preindustrial terrestrial carbon cycle consisted of atmospheric CO_2, together with the energy of sunlight and the photosynthetic process of plants, to create carbon-rich organic compounds. Respiration of plants and organisms feeding on plants or other organisms returns CO_2 to the atmosphere. Oceans also absorb huge quantities of CO_2, which is then incorporated into photosynthesizing organisms such as phytoplankton.

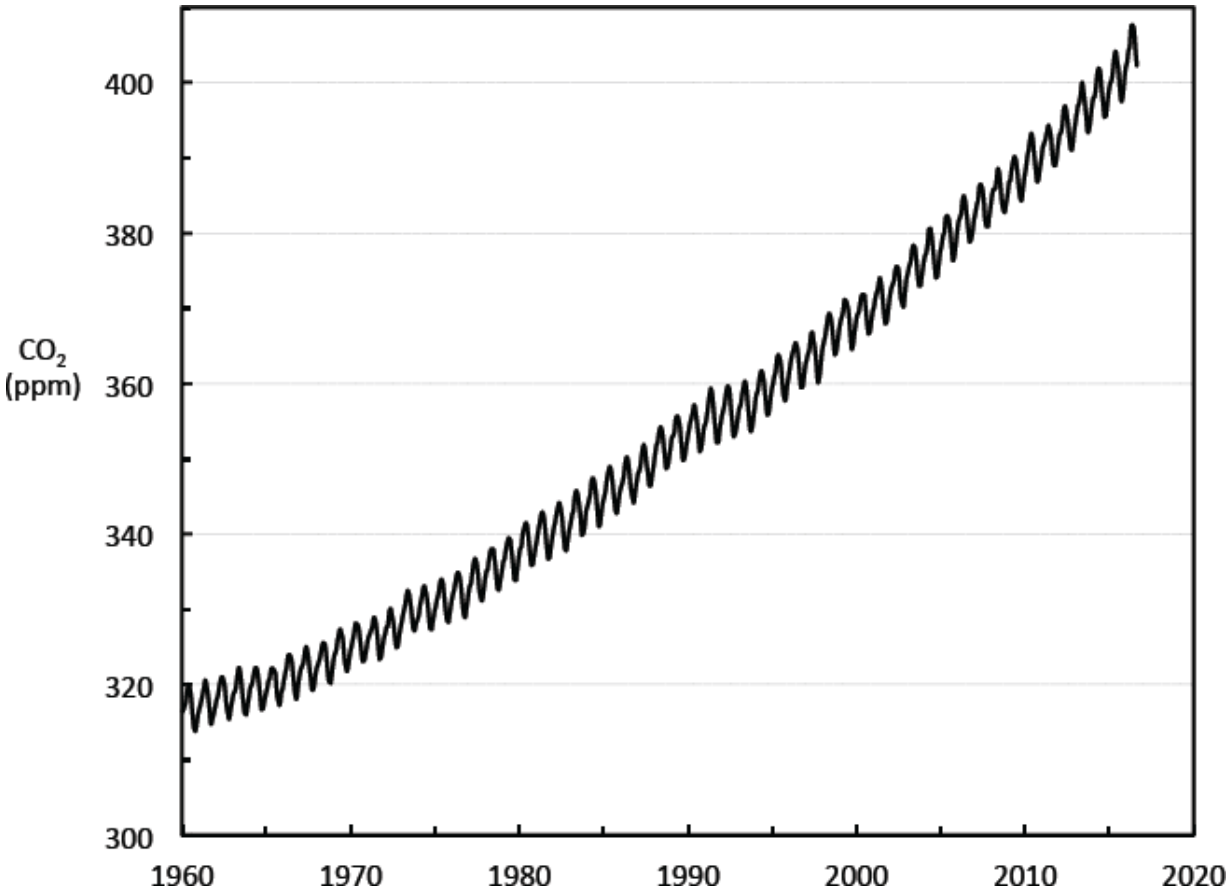
Dissolved CO_2 is combined with calcium by shell-forming animals to produce calcium carbonate ($CaCO_3$), which they take to the ocean bottom when they die, safely sequestering the carbon.

Before the use of fossil fuels, humans burned wood and, later, crop residues, manure, and peat for heating, cooking, and light, returning to the atmosphere more CO_2 captured by plants than by food consumption and bodily respiration.

The dramatic changes to the carbon cycle brought about by human activity, and greatly accelerated during the period following the Second World War, was caused by land use changes (about 25 percent of the increase in greenhouse gas release) and the use of fossil fuels (about 75 percent of the increased emissions). As a result, the average concentration of CO_2 in the atmosphere has climbed from a pre-industrial baseline of 280 parts per million (ppm) to over 400 ppm—a level last reached some 23 million years ago.[12] The longest continuous monitoring of atmospheric CO_2 is from the Mauna Loa Observatory in Hawaii. Figure 3.3 shows the rapid increase in CO_2 from 1960 to mid-2016.[13]

Approximately 45 percent of the excess carbon dioxide remains in the atmosphere and contributes to global warming, while 30 percent dissolves into the oceans, causing them to gradually acidify, and 25 percent is removed by terrestrial plants. Hotter, more acidic seawater leads to coral bleaching and makes it more difficult for animals such as oysters and lobsters (as well as corals) to form their calcium carbonate shells.

Figure 3.3: Atmospheric CO_2 Concentration (through August 2016).



Source: R. F. Keeling, S. J. Walker, S. C. Piper, and A. F. Bollenbacher, Scripps CO_2 Program (http://scrippsco2.ucsd.edu), Scripps Institution of Oceanography (SIO), University of California, La Jolla, California.

Land Use Changes

The world's soils contain enormous stores of carbon as organic matter, composed of animal and plant residue in different stages of decomposition as well as living organisms. Altogether, soils contain about five times more carbon than is found in Earth's atmosphere.[14] For every 1 percent of organic matter in a soil—and temperate-region agricultural soils normally have between 1 and 6 percent organic matter by weight—the amount of carbon in the top 6 inches of a field's soil is approximately equivalent to all the CO_2 in the atmosphere above the field.[15]

With the shift to agriculture, major changes occur. The original vegetation is frequently burned, releasing CO_2. In addition, soil disturbance such as tree removal and plowing result in soil organisms having greater access to organic matter and decompose it at an accelerated rate. Thus, converting forests or savannas to agriculture results in a large release of CO_2 into the atmosphere and a simultaneous loss of a significant portion of the soil's organic matter, perhaps as much as half, as organisms use increasing amounts of newly available organic matter for energy. For a prolonged period following conversion, soils are a net source of atmospheric CO_2, though this can be reversed with suitable agro-ecological techniques.

From the very beginning of capitalism, land conversion accelerated due to the drive to produce profits. There was cotton to grow in the U.S. Southeast to feed the mills of England. There was sugarcane to grow in South America and the Caribbean islands. There was widespread destruction of grassland and forest ecosystems to grow crops, monoculture forests, and plantations. These practices contributed to the rise in atmospheric carbon dioxide levels.

The imperatives of seeking profits caused increased production of crops to be processed into a variety of products to stock supermarket shelves, feed animals, and supply fuel to cars with crop-based ethanol and biodiesel. This problem persists today. The push to grow more soybeans for export to an expanding Asian market was one of the driving forces for the conversion of Amazon forest to pastureland and then to cropland in the first fifteen years of the twenty-first century. In addition to the accelerated decomposition of soil's organic matter, the common practice of burning to clear land pumps CO_2 directly into the atmosphere and explains why Indonesia is the fifth largest carbon emitter.

The situation of today's rain forests in Indonesia and Malaysia is especially problematic because many of its forests have soil composed of peat. It is estimated that the losses of organic materials following drainage and conversion to oil palm plantations have caused the release of about 3,000 tons of CO_2 per acre (about 3,000 metric tons per hectare) over fifty years.[15] Although palm oil is used for foods and cosmetics, it is increasingly being used as a "green" biodiesel and pushed in the European market as a

substitute for fossil fuel–derived diesel. It is estimated that it will take *over 400 years* of growing oil palm and using it as a substitute for petrochemical diesel to make up for the CO_2 generated by the destruction of the rain forest and the associated burning of land and loss of carbon from soils through accelerated decomposition.[16] (Another consequence of this practice is the irrevocable social and ecological devastation of replacing biodiverse rain forest with palm oil plantations.)

In 2015, in the wake of El Niño, Indonesia's rain forests experienced a spell of extreme dryness. Fires set to burn the felled trees from forest clearing for conversion to oil palm plantations got out of control. In August, the fires were so extensive that thick smoke settled over a region that included Singapore and Malaysia, parts of the Philippines, and Thailand. The fires sickened hundreds of thousands of people and took a severe toll on wildlife, including orangutans, our near-relatives. The *New York Times* reported about the fires:

> Luhut B. Pandjaitan, Indonesia's coordinating minister for political, legal and security affairs … said the country's "one mistake" was in approving palm oil concessions on 14.8 million acres of peatlands during the past decade, which when drained and burned to clear land for agriculture emit high levels of carbon dioxide into the air.[17]

Calling policies that caused such ecological and human tragedy a "mistake" is quite an understatement, particularly as it was all so predictable. The Indonesian fires were the most costly "natural" disaster of 2015, causing an estimated US $16 billion in damages.[18] A study by researchers at Harvard and Columbia Universities puts the number of people who will die prematurely due to smoke inhalation from those fires at 100,000.[19] The 1997 Indonesian fires, also a result of dry El Niño conditions, were estimated to have caused a significant portion of the world's CO_2 emissions for that year.[20]

Rise of Fossil Fuels

Over the last three hundred years, there has been large-scale burning of fossil fuels to provide power and heat. Coal and then oil and natural gas are used in ever-increasing amounts, pumping CO_2 into the atmosphere as a by-product.

Along with capitalist social relations and new inventions, the energy concentrated in fossil fuels was key to the speed and manner in which the Industrial Revolution took off.[21] The system has grown to the point that today the burning of fossil fuels accomplishes the work equivalent of an estimated 25 billion people working 10 hours a day, 365 days a year.[22] Tom Wessels, in *The Myth of Progress*, described the magnitude of fossil fuel consumption in other terms: "For the first time in Earth's history, a single species is responsible for the entropic degradation of the biosphere by releasing more energy through transformation than is being replaced by global photosynthesis."[23]

As increased atmospheric CO_2 drives increasing temperature, feedback loops occur. Permafrost soils that have been frozen for millennia, comprising almost a quarter of the land of the Northern Hemisphere, are beginning to melt. They hold a huge amount of carbon, stored as both organic matter and as methane gas (CH_4). As these soils warm and thaw, they release large quantities of greenhouse gases—CO_2 from decomposing organic matter and methane—leading to even more global warming. It is estimated that this feedback loop may result in up to 15 percent of the carbon stored in permafrost ending up in the atmosphere by the end of the century.[24]

This massive amount of fossil fuel combustion is one of the major interventions made in the carbon cycle. Instead of a relatively stable amount of atmospheric carbon cycling from the atmosphere to plants, soils, and animals and then returning to the atmosphere, which existed for centuries, ever-greater amounts of CO_2 accumulate in the atmosphere and the oceans. The results are the warming planet and acidification of the seas. The warming of the atmosphere, in turn, has led to drastic changes in climate and to much suffering.

Remedial Solutions

To date, attempts to counteract or reduce human-induced alterations to the carbon cycle and resulting climate change have all proved inadequate. These "solutions" don't go far enough either because there has been no desire to disturb corporate profits or they offer new possibilities to profit through market-based approaches that can lead to further problems. A number of more desperate and even more destabilizing proposals have been made for large-scale geoengineering, such as shooting sulfate particles into the atmosphere to reflect a portion of incoming light from the sun, thereby lessening warming of Earth.

While biofuels are regarded by some as a significant part of the solution, their impacts are mostly negative: on people, land, water, and biodiversity. Many problems are the result from the many side effects of capitalist agricultural production in general, such as environmental contamination with pesticides and with synthetic fertilizers, but need to be considered as outcomes when growing crops for biofuel production. Additionally, land that could have been used to grow food for people is used to grow fuel for cars: some 40 percent of the U.S. corn crop is used to make ethanol fuel. In addition, the land grabs and deforestation that occurs in order to grow oil palm in order to make "biodiesel" has enormous adverse consequence for people, wildlife, and the atmosphere as we described earlier. Some biofuels take even more energy to produce than they yield. The extent of their impacts depends on the particular biofuel crop grown, production and processing of biofuel feedstocks, the scale of production, and how they influence land-use change as to who gets displaced. Finally, while using some types of biofuels might reduce CO_2 emission to the atmosphere, others emit more CO_2 than with fossil fuels. Thus, this supposed remedy for the negative effects of fossil fuels has so many harmful side effects that is no solution at all.[25]

Some scientists advocate the expansion of nuclear power as the only way to effectively reduce emissions of carbon dioxide at the scale required. Aside from myriad safety problems with the operation of nuclear plants—and the high costs of electricity generation—a process for the safe disposal of nuclear waste, which remains radioactive for hundreds of thousands of years, is not yet known.

One often-cited emerging technology, carbon capture and storage (CCS)—essentially capturing and permanently burying carbon dioxide below ground—is untried and untested at anything close to the scale needed to make a difference. Its advocacy promotes the idea that we can carry on burning fossil fuels because at some point we'll be able to store the gaseous waste product. CO_2 captured in the pilot CCS projects is mostly pumped underground in order to pump out more oil.[26]

Even more fraudulently, individuals are encouraged to compensate the world for the carbon used in commercial airplane flights and other activities by purchasing so-called offset credits (see discussion later in this chapter on Putting a Price on Nature). There are a number of problems inherent in these schemes, especially a lack of accountability or oversight that encourages cheating and gaming of the system. A report by the Oakland Institute, an independent policy think tank, concluded that "there is mounting evidence that … corporate land acquisitions for climate change mitigation—including forestry plantations—severely compromise not only local ecologies but also the livelihoods of some of the world's most vulnerable people living at subsistence level in rural areas in developing countries."[27]

Organic Matter Flows and Soil Health

The organic matter cycle is a key part of the carbon cycle—after all, the material of life is built out of chains and rings of carbon atoms, assembled by the photosynthetic activity of green plants. Organic materials are stored aboveground in living plants and animals and in much larger quantities in soils as both living organisms and the residues of dead ones. As discussed earlier, agricultural practices have led to a large loss in soil organic matter, contributing to increases in atmospheric CO_2 levels. But because organic matter levels in soils have such profound effects on agriculture and the environment, it needs attention as a separate issue.

Ample amounts of organic matter are of critical importance to maintaining healthy and productive soils. As soil organic matter content decreases, biodiversity decreases and disease organisms and nematodes that feed on crop plants proliferate because of the decreased competition with

other organisms. In general, the simpler rotations of modern industrial-style farming make crop pests—weeds, soil-borne diseases, and insects—more problematic when the soils are depleted of organic matter.[28] As organic matter decreases, soils become more compact and less water is able to infiltrate. Fewer nutrients are stored in soils and soil nutrients are more easily lost to leaching and erosion. Accelerated erosion causes a further loss of organic matter along with the lost topsoil. The loss of topsoil and organic matter creates a downward spiral of soil fertility. More aggregates break down and more erosion occurs. It's a classic feedback loop: the original disturbance causes other changes that further magnify the first disruption. Drastic intervention with fertilizers, pesticides, extra irrigation, and equipment will temporarily remedy the situation—but at a great ecological, monetary, and social cost.

Some early agricultural practices reduced soil organic matter, such as when wheat was grown on the hillsides of Greece, resulting in erosion of topsoil rich in organic matter and negative effects for long-term food production. But other cultures developed methods to help maintain soil fertility. The Mesoamericans developed the *chinampa* system in the Valley of Mexico: planting beds were built, using sediments rich in organic matter from shallow lakes.

Disturbances in organic matter flows were recognized over a century ago. Three scientists examining the problem of "worn-out" soils in 1908 concluded that the "depletion of the soil humus [organic matter] supply is apt to be a fundamental cause of lowered crop yields."[29] Contemporary soil scientists have only recently rediscovered this reality.[30]

Practices that developed and were made common during the industrialization of agriculture—such as inadequate crop rotations composed of relatively few commodity crops, reliance on nitrogen from commercial fertilizers instead of legumes, the concentration of large numbers of farm animals separated from the land that grows their feed, and intensive tillage that breaks up soil structure—have led to a great loss of soil organic matter. Agricultural soils in the United States have about half of the organic matter they contained before forests and grasslands were converted to agriculture.[31] It is estimated that the world's soils have lost between 50 and 70 percent of the organic matter they contained before they

were farmed.[32] Over 30 percent of the world's soils are moderately or severely degraded.[33]

Pesticides are routinely used to control organisms that limit crop growth. But more insecticides are needed because plants are more susceptible to insect attack when growing in soils depleted of organic matter and in fields and their surroundings that have low plant biodiversity. In other words, farming practices developed within the context of capitalist economies that focus on monocultures or use inadequate rotations have created large populations of insect pests (in the sense of attacking crops and reducing yields) by eradicating all their competitors and natural predators as well as decreasing the presence of organisms in the soil that stimulate plants to produce chemicals to defend themselves.

Pesticide contamination of farmers, farm workers, water, and the food itself is pervasive. Natural enemies are killed along with the target pests, frequently leading to the outbreak of previously insignificant secondary pests. As target pests develop resistance to the pesticides used, a treadmill is created, necessitating higher pesticide application rates, the use of multiple pesticides, and the continual introduction of new pesticides. This creates a chemical arms race between crop pests and pesticide makers, driving pests to evolve resistance to widely used pesticides. The occurrence of many pest problems on industrial agriculture farms is an outcome of farming under the constraints of capitalist economics and ideology rather than a product of nature. This is partially a result of practices that, among other effects, decrease soil organic matter.

More fertilizer is needed as organic matter decreases because the nutrient-supplying ability of soils is tied so intimately to the amount of organic matter present. And decreased organic matter reduces the amount of rainfall that can infiltrate and be stored in soils, leading to rifts in the hydrologic cycle. This is then counteracted by more frequent irrigation. While these so-called remedies—pesticides, synthetic fertilizers, more irrigation—help to maintain high yields in the short term, crop yields are usually lower than would occur with soils richer in organic matter.

The Hydrologic Cycle

Freshwater comprises less than 2 percent of the earth's total water, and is unevenly distributed around the globe. Freshwater is needed for drinking, irrigating crops, raising farm animals, and many other human endeavors. Thus, the questions of how water cycles—where it rains and where it doesn't, how much it rains and the intensity of rainfall, and how much of the rainfall infiltrates the soil and how much runs off the land—are all critical. Today the cycling of water is being significantly distorted in a number of ways: changes in rainfall patterns as global warming proceeds, pumping water from subsurface aquifers (permeable strata) faster than replenishment occurs, transporting water long distances to supply another region, excessive use during irrigation and growing water-needy crops in regions with inadequate rainfall, and contamination of surface and subsurface water with industrial chemicals.

Freshwater will soon be the key resource that nations will fight over. Already there are struggles between the states of Georgia and Florida over water use, and the disagreements among western U.S. states are legendary. Dams built by China and other countries along rivers, without being part of a regionally agreed-upon water allocation strategy, lead to headlines like the *Guardian*'s "A Waterfight Like No Other May Be Brewing Over Asia's Rivers."[34] Upriver dams, used for irrigation and producing hydroelectric energy, lessen the downriver flows and change the annual flow patterns, harming river fisheries and other traditional uses.

The earth's warming is projected to increase drought stress in northern South America and parts of Central America and Africa and decease water availability in the large river basins of Southeast Asia. On the other hand, greater precipitation, much of it in more intense storms, is anticipated for portions of the continental United States.[35] Regions with increased probabilities of intense storm occurrences includes parts of England, Southeast Asia, and the Pacific coastal regions of Colombia and Ecuador.

Perhaps as an indication of what is in store for the United States, for a period of a little over twelve months beginning in May 2015, "dozens of people [were] killed and thousands of homes swamped with water in extreme events in Oklahoma, Texas, South Carolina, West Virginia and Maryland."[36] The National Oceanic and Atmospheric Administration reported that eight 500-year storms occurred during this period. The devastating storms that hit Louisiana in August 2016 dropped up to 24

inches (60 cm) of water over a forty-eight-hour period. “The Louisiana flooding has been so exceptional that some places in the state experienced storm conditions considered once-every-1,000-year events.”[37]

During normal rainfall events, an estimated 60 percent of the precipitation that falls on land enters the soil and is stored there. The remaining 40 percent either flows through the soil into aquifers and springs or overland into streams, rivers, lakes, wetlands, and oceans. Removal of native vegetation and conversion of forests and grasslands to plowed fields decreases soil organic matter and disturbs natural soil structure, decreasing the amount of rainfall infiltrating soil, leading to accelerated runoff and erosion as flowing water carries soil sediments downhill.

Large-scale agriculture, stimulated by economic incentives that encourage growing row crops and covering ever-larger land areas, have accelerated the natural process of soil erosion.[38] For example, more than half of Iowa’s topsoil—originally fourteen inches deep—has been eroded by water flowing over soils used to grow corn and soybeans.[39]

Huge expansions of urban and suburban areas have resulted in increasing portions of land being covered with impermeable structures: houses, commercial buildings, schools, roads, driveways, and, in particular, parking lots:

> It’s estimated that there are three nonresidential parking spaces for every car in the United States. That adds up to almost 800 million parking spaces, covering about 4,360 square miles—an area larger than Puerto Rico. In some cities, like Orlando and Los Angeles, parking lots are estimated to cover at least one-third of the land area, making them one of the most salient landscape features of the built world.[40]

Sealing so much of the soil surface contributes to large pulses of runoff from storms, swelling local streams and rivers and leading to flooding and water pollution.

Irrigating agricultural fields uses the largest amount of water by far, accounting for 70 percent globally. In California, agriculture accounts for 80 percent of total freshwater use. A sizable further portion is used (and polluted) by the oil and gas industry due to the huge increase in horizontal

drilling (fracking) that produces enormous quantities of contaminated wastewater. The U.S. Geological Survey (USGS) estimates that up to 9.6 million gallons of water are used for every fracking well.[41] Even the oil and gas industry recognizes its use of a huge amount of water. In a series called *Measuring Success*, the engineering firm Siemens, which builds monitoring equipment for wells, claims that "the biggest product of the US petroleum industry [is] water." If the idea of oil and gas companies producing water sounds strange, that's because it is. "Produced water" is an Orwellian term invented by the industry used to describe the toxic cocktail of fracking chemicals and contaminated water the industry disposes of by burying it underground.

Reinjection of fracking wastewater into the ground has dramatically increased the frequency of earthquakes. The state of Oklahoma, where earthquakes were rare, now experiences them as often as California.[42] In the Dallas–Fort Worth area earthquakes had never before been recorded until 2008, after wastewater injection took off. Local resident Cathy Wallace describes having to contend with the knowledge that quakes could come at any time: "Every time it happens you know it's going to hit, but you don't know how severe it's going to be…. Is this going to be a bigger one? Is this the part where my house falls down? It's scary. It's very scary."[43] The USGS estimates earthquakes caused by wastewater injection will threaten the lives and livelihoods of up to *7 million people* in the United States.[44]

What's most remarkable is that we have known for decades that injecting large quantities of high-pressure liquid into the ground is a direct cause of earthquakes. Experiments in the 1960s conclusively demonstrated the exact amount and pressure of liquid required to destabilize a fault. In reference to these experiments, Stanford University geophysicist Bill Ellsworth notes, "Scores of papers on injection-induced earthquakes were published in the geophysical literature in the following 40-plus years [1960s on], and the problem was well understood and appreciated by seismologists."[45]

One of the arguments against shutting down fracking operations (actually doing almost anything improves the environment) is the environment-versus-labor argument. It will cost jobs. But plenty of workers would be needed if society decided to invest in public transit, upgrade infrastructure, and design and build a new electricity grid based on

renewable energy. Shutting down the fracking industry will free up workers to do more socially useful and ecologically sound jobs.

As water is withdrawn too rapidly from the earth, aquifers in dry climates become depleted. *New York Times* reporter Felicity Barringer wrote in 2015, "nearly a third of the world's 37 largest aquifers are being drained faster than they are being replenished."[46] Drilling deeper wells is just another temporary fix. Sometimes it causes the land to collapse. This is what's happening in California's Central Valley, where one-quarter of the food consumed in the United States is produced annually. In 2015, after four years of drought, the land was sinking at the rate of two inches (5 cm) a month.[47]

As the land sinks, roads, bridges, and pipelines need major repairs, costing tens of millions of dollars. The extent of underground water depletion has also led to saltwater intrusions into coastal aquifers and significantly contributes to sea-level rise because water that would have remained in aquifers on land reaches the ocean. This occurs mainly because evaporation and transpiration caused by irrigation later returns to earth as rainfall.[48]

Capitalism's top-down solution to insufficient regional supplies is to dam and divert rivers and build pipelines and canals that transport water long distances from water-rich regions. Such projects have been carried out in country after country, at huge ecological and social cost. One example in the U.S. context is the Colorado River diversion. In order to supply water for western U.S. cities and agriculture, more "than 100 dams were built across the [Colorado River] system. Where the river's path was inconvenient, its reach was extended with tentacles of tunnels and trenches deep into Southern California and Arizona. Parts of the river were even reversed; water was sent eastward through pipelines beneath the Continental Divide."[49]

In addition to its huge social-ecological costs, the Colorado River diversion also uses enormous amounts of energy to move water thousands of feet up over mountains and through tunnels and canals to Phoenix and Tucson. The Navajo Generating Station, built primarily to provide the energy needed to move water from the river, uses 15 tons of coal a minute and emits a plume containing 16 million tons of CO_2 annually, along with

other pollutants such as mercury and lead.[50] The power plant has turned the Navajo reservation and surrounding region into a "national sacrifice area." EPA records include complaints of a doubling in cancer rates in the Navajo Nation since the generating station began operating, as well as worsening asthma. The nonprofit environmental organization Clean Air Task Force estimates that emissions from the Navajo plant alone were responsible for twelve premature deaths in 2012.[51]

The amount of evaporation along the sun-drenched route of the diversion and in the associated dams further calls into question the overall long-term sustainability and benefits of moving such vast quantities of water to an arid region. The point is not that major infrastructure projects are inherently bad and should never be contemplated under any circumstances. Rather, such projects must be evaluated by different criteria than those currently used for capitalist projects—criteria that include social justice, equity, a genuine assessment of long-term sustainability and outcomes in a truly democratic decision-making process that involves everyone who may be affected.

Over half the world's population, some 4 billion people, live in areas where for at least one month during the year water is being used at more than twice the replenishment rate.[52] As supplies of freshwater become less dependable and the need for water grows in a warming climate, it will be the poor that suffer most. Because in our society, as Dan Baum writes, "the first law of hydrodynamics is that water flows toward money."[53]

Biodiversity

The ongoing loss of biodiversity is creating rifts in the entire web of life. A 2012 article in *Science* sums it up as follows:

> Ecosystems worldwide are rapidly losing taxonomic, phylogenetic, genetic, and functional diversity as a result of human appropriation of natural resources, modification of habitats and climate, and the spread of pathogenic, exotic, and domestic plants and animals. Twenty years of intense theoretical and empirical research have

> shown that such biotic impoverishment can markedly alter the biogeochemical and dynamic properties of ecosystems.[54]

Scientists have estimated that the loss of mammals and other vertebrates over the last century would have taken between 800 and 10,000 years to occur if extinction rates had remained unchanged.[55] This rapid decrease in species, now well underway, has been called the "sixth extinction."[56]

Rapacious exploitation of the oceans is also occurring. According to a 2010 report from the Pew Charitable Trusts:

> Of the nearly 600 species groups monitored by the United Nations' Food and Agricultural Organization, only 23 percent are not fully overexploited. Many fisheries scientists consider even this estimate to be optimistic. Recent studies suggest that 90 percent of the world's large fish have disappeared, that close to one-third of the world's commercial fisheries have collapsed.[57]

The harvest of ocean fish peaked at an annual catch of about 130 million tons in the 1990s and "the world's annual catch is now decreasing by more than 1 million tonnes [about 1 million tons] every year—despite the availability of the latest fishing technology: nets big enough to engulf cathedrals, echo locators, satellite navigation, and powerful engines to drive boats."[58] The downward trends of world catches are especially ominous because more than 2 billion people depend on seafood for their primary source of animal protein.[59]

In addition to overfishing (including millions of tons of bycatch annually caught in huge nets and then discarded), pollution and warming seas are endangering aquatic populations. According to a 2016 study: "Without a dramatic shift in the business-as-usual course for marine management, our analysis suggests that the oceans will endure a mass extinction."[60] With regard to the largest of the marine vertebrates, though no whale species have become extinct, their numbers have declined between 66 and 99 percent (for blue whales) because of commercial whaling.[61]

As a result of the enormous changes brought about by the forces of the "great acceleration," the World Wildlife Fund estimates that if current trends continue through 2020, there will be about two-thirds fewer wild

animals on the planet than existed in 1970.[62] Yet overexploitation of wild animals is nothing new: it occurred even in the early days of capitalism. In describing early commercial-scale hunting in the Cuyahoga Valley in what is now Ohio, John Tully wrote: “Foxes, otters, wolves, moose, elk, deer, cougars, buffaloes, and a variety of other animals fell before the settlers’ guns in huge numbers, some species never to recover.”[63]

In addition to the genocide of indigenous peoples and the consequences for animals, settler colonialism has been similarly calamitous for native vegetation. The decline or elimination of original animal and plant populations was a result of exploitation of renewable and nonrenewable resources to feed an insatiable economic system.

Accelerated settler theft of land and increased trade encouraged the introduction of many invasive species that have displaced native species. Indeed many early colonists actively tried to reproduce their country of origin through the deliberate propagation of the seeds and animals they brought with them. Early humans may well have had a hand in the loss of a number of species as they spread throughout much of the world. However, the evidence of prehistoric human-induced extinction of large animals is sometimes ambiguous, and the coexistence of humans and mastodons in North America for a significant period of time certainly makes one question the rapid-extinction narrative.[64] Regardless of the extent of ancient human participation in the demise of many large animals, those losses pale in comparison to what occurred during and after the development of capitalism and is occurring right now as a result of the imperatives of capitalist production.

The removal of a top predator has numerous effects on species in other parts of the food web and the physical landscape, resulting in what is called a “trophic cascade.” When a top predator is removed, as wolves were in much of the United States to protect farm animals such as sheep or to eliminate predation of game species, populations of species that were once regulated by availability of food and the presence of a top predator may grow, causing overgrazing and a simplification of the remaining habitat. Returning a small population of wolves to Yellowstone National Park has led to dramatic improvements in biodiversity and the physical makeup of the park.[65]

Agriculture, whether on soils that previously supported rain forest, temperate forest, or grasslands, always involves eliminating most, if not all, of the native vegetation to grow crops and raise animals, thereby creating a biologically simplified system in place of what came before. However, capitalist agriculture has been especially proficient at decreasing biological diversity in the soil, in the fields, in the borders surrounding the fields, and in the genetics of crops and farm animals.

Much of the current loss of biodiversity, discussed earlier as part of the carbon cycle, is the result of conversion to industrially managed forests, plantations, pastures, or croplands. The Amazon rain forest is believed to be composed of 16,000 tree species.[66] When converted to soy production only one plant species dominates. And when converted to grasslands for animals to graze, only a few species of plants are present in the pastures. In addition, a wide diversity of animal life, small and large, aquatic and terrestrial, in and around the trees and in the soil, is lost during the habitat conversion.

Ecological simplification, using uniform genetics to produce a uniform "product," also occurs on factory farms. Billions of domesticated animals are treated by the meat, dairy, and egg industry not as living creatures that can feel pain and distress, but as machines. Mass-produced in factory-like facilities, their bodies are shaped in accordance with industrial needs. They pass their entire lives as cogs in a giant production line, and the length and quality of their existence is determined by the profits and losses of business corporations. Genetically similar (some even uniform) livestock raised in crowded industrial conditions foster disease, requiring routine use of antibiotics to attempt to solve the problem.

Agribusiness in the United States has become so concerned about animal rights activists filming its abusive practices that the industry actively lobbied for legislation criminalizing the practice. With the passage of the Animal Enterprise Terrorism Act of 2006, anyone caught filming the horrifying conditions inside an animal processing center or factory farm (officially known as Concentrated Animal Feeding Operations, or CAFOs) can be tried as a terrorist under federal law.[67] The law applies not only to those filming the cruel conditions of the animals but also to workers who film unsafe or unhealthy working conditions inside the CAFO.[68]

One of the key findings of a summit titled *Seeds and Breeds for the Twenty-First Century Agriculture* is that there is "increased vulnerability of

agricultural systems to weather or pest disruptions due to the decline of agro-biodiversity on farms and in our commercial seed choices."[69] Decreased biodiversity on farms occurs within fields, genetically, over time and space.[70] Biological impoverishment by species loss leads to reduced self-sufficiency and self-regulation of ecosystems, including agricultural ones, and leads farm animals and crops to greater vulnerability from pests.

Capitalism as Poisoning Agent

With the growth of capitalism came the emergence of the synthetic chemical industry. Many useful and beneficial new substances and products have been created over the last few decades. But when the primary objective is profitability, examples abound of toxic materials and products routinely used in a wide variety of products and introduced into the air, water, and soil. These include metals such as lead, mercury, and chromium; minerals such as asbestos; and a large number of industrially produced organic chemicals such as polyfluoroalkyl and perfluoroalkyl substances (PFASs). The "overwhelming majority of chemicals in use today have never been independently tested for safety in the United States."[71]

> In its history, the EPA has mandated safety testing for only a small percentage of the 85,000 industrial chemicals available for use today. And once chemicals are in use, the burden on the EPA is so high that it has succeeded in banning or restricting only five substances, and often only in specific applications: polychlorinated biphenyls, dioxin, hexavalent chromium, asbestos, and chlorofluorocarbons.[72]

The most severe contamination of humans with toxic chemicals commonly arises in the workplace: farmworkers are exposed to high levels of pesticides, miners are exposed to high levels of uranium or coal dust, and so on. The general public is also exposed to a multitude of potentially toxic chemicals through household products, air, drinking water, and food. "Scientists have identified more than 200 industrial chemicals—from pesticides, flame retardants, jet fuel—as well as neurotoxins like lead in the blood or breast milk of Americans, indeed, in people all over our planet."[73]

Our bodies have become “toxic waste disposal sites.”[74] According to the 2008–2009 report of the President’s Cancer Panel, we are contaminated even before birth: “Numerous environmental contaminants can cross the placental barrier; to a disturbing extent, babies are born ‘pre-polluted.’”[75]

Endocrine disruptors are one such example of this “pre-pollution.” These disruptors include “pharmaceuticals, dioxin and dioxin-like compounds, polychlorinated biphenyls [PCBs], DDT and other pesticides, and plasticizers such as bisphenol A [BPA]. Endocrine disruptors may be found in many everyday products—including plastic bottles, metal food cans, detergents, flame retardants, food, toys, cosmetics, and pesticides.”[76] The Endocrine Society, in its 2015 report on endocrine disruptors, stated the following: “Emerging evidence ties endocrine-disrupting chemical exposure to two of the biggest public health threats facing society—diabetes and obesity…. Mounting evidence also indicates EDC [endocrine-disrupting chemical] exposure is connected to infertility, hormone-related cancers, neurological issues and other disorders.”[77]

The chemical industry has grown from $171 billion in 1970 to $4.12 trillion in 2010. Most chemical production still takes place in OECD (Organization for Economic Co-operation and Development) countries, but there is significant industry growth in China, South Africa, and other developing countries. With hundreds of new chemicals emerging every year, production is predicted to continue to grow exponentially alongside economic growth.

Over the last forty years, as the power of capital has grown relative to labor, there has been a weakening in the enforcement of worker safety rules. This has reintroduced workplace hazards such as black lung, a disease of coal miners resulting from coal dust inhalation. It had decreased to almost zero following regulations of mine dust, but a strong resurgence has occurred since 2000. Over the next twelve years, black lung incidence in miners who had worked at least twenty-five years increased by 900 percent.[78] After twenty-nine miners were killed in the 2010 explosion at the Upper Big Branch Mine in West Virginia the state medical examiner autopsied the dead miners. Illustrating that black lung is really a social affliction caused by unequal power relations, there was:

> sufficient lung tissue for postmortem examination in 24 of the 29 victims, and 71% (17 of 24) were noted to have pathologic findings of CWP [coal worker's pneumoconiosis, aka black lung]. The 17 miners whose lungs showed CWP ranged in age from 25 to 61 years, including five who had less than 10 years' mining experience; nine had been miners for more than 30 years. Of note, 16 of the 17 miners with CWP had started working after the modern dust limits were put into effect.[79]

Estimated Cost of Global Environmental Impacts

It is next to impossible to put a true monetary cost on the ecological impacts of capitalism. How do you put a meaningful cost on the effects of human contamination by lead, or the disappearance of a species, or the destruction of a forest? Although we are skeptical about trying to do so, a number of groups have made such estimates, and these dollar amounts give at least some idea of the magnitude of the devastation.

For example, a 2015 UN-sponsored study estimated the annual unpaid costs of global industrial agriculture at over $3 trillion—*significantly more than the economic value of the food produced*.[80] An earlier study, also sponsored by the UN, estimated that in 2008 the environmental damage caused by the world's 3,000 largest publicly traded companies was equivalent to $2.2 trillion.[81] When the sportswear company Puma decided to "go green" and put together an environmental profit and loss account in 2011, it quickly found that, if implemented, the corporation would have to dissolve itself.[82]

Unnatural Natural Disasters

The term "natural disaster" takes on new meaning when the activities of businesses and governmental bodies create conditions that both make the effects of potential disasters worse than they would otherwise be and ensure that it is the poorest that are most affected. We've already mentioned the "natural" disaster resulting from destruction of Indonesian rain forests.

For another example, the building of numerous dams on the Mississippi River has greatly reduced the amount of sediment reaching the delta each year. And because the land in the delta naturally subsides and because ocean levels are rising, this lack of replenishment of sediment results in land being swallowed by the waters of the Gulf of Mexico. However, there is an additional factor at work—the operation of the oil companies. Thousands of onshore and offshore oil drilling rigs and canals dug for transportation and pipelines have damaged wetlands and accelerated erosion of the low-lying delta lands, making them more susceptible to hurricane tidal surges. “In just 80 years, some 2,000 square miles of its coastal landscape have turned to open water, wiping places off maps, bringing the Gulf of Mexico to the back door of New Orleans and posing a lethal threat to an energy and shipping corridor vital to the nation’s economy.”[83]

When a storm like Hurricane Katrina hits, the surge swamps communities in the low-lying delta. It is then able to travel farther inland than if there had been more land acting as a buffer. When Katrina devastated New Orleans in 2005 the poorest residents were the most severely impacted. As distinguished geographer Neil Smith wrote:

> It is generally accepted among environmental geographers that there is no such thing as a natural disaster. In every phase and aspect of a disaster—causes, vulnerability, preparedness, results and response, and reconstruction—the contours of disaster and the difference between who lives and who dies is to a greater or lesser extent a social calculus…. Unfortunately, shocking as it was, the tragedy of New Orleans is neither unique nor even especially unexpected, except perhaps in its scale. The race and class dimensions of who escaped and who was victimized by this decidedly unnatural disaster not only could have been predicted, and was, but it follows a long history of like experiences.[84]

Similarly, five years after Hurricane Sandy struck New York City in 2011, the community in Far Rockaway is still struggling. During the August 2016 rainstorm in southern Louisiana, eleven people died and tens of thousands of homes were destroyed or damaged. Although the storm was

particularly severe, it was not primarily accountable for the loss of life and extensive property damage. Edward Richards, a professor at Louisiana State University, observed that the real problem was how the area was developed:

> From a land use perspective, the primary problem was that local planning and zoning commissions have known that the areas are prone to severe flooding for at least the 30 plus years since the 1983 flood. Homeowners and small businesses were not warned about the risk and were not advised to buy flood insurance if they were outside the FEMA 100-year flood zone. They relied on planning and zoning commissions to determine if developers were building in safe locations.[85]

In these examples, as developers and planners accommodate the profit-making desires of capital—ripping up natural flood defense systems, inducing people to move onto marginal land, and then neglecting to utilize sufficient resources to help them—made the disasters inevitable. As climate change progresses and brings both drought and more intense storms, the problem of unnatural natural disasters will only worsen.

The Role of Waste in Capitalist Economies

More production means more waste: more waste means more production. Waste is a sign of capitalism's success. When people throw away a product after using it for a short period of time, in the spirit of planned obsolescence, they will buy a new one, contributing to growth and corporate profits.[86]

As early as the 1920s Stuart Chase identified four systematic sources of waste under capitalism: (1) the labor power used to produce "vicious or useless goods and services"; (2) labor power wasted due to unemployment; (3) the unplanned nature of production and distribution of goods leading to inefficiencies and overproduction; and (4) the senseless waste and overuse of natural resources.[87] Addressing the term coined by nineteenth-century writer and social reformer John Ruskin, Chase wrote that what capitalism produces is not wealth, but "illth."

Illth abounds under capitalism. In *Monopoly Capital: An Essay on the American Economic and Social Order*, first published in 1966, Paul Baran and Paul Sweezy included an appendix by Joseph D. Phillips titled "Estimating the Economic Surplus." Phillips demonstrated that the economic surplus—aspects of the economy that served no socially useful purpose and would therefore be considered waste in a more rationally organized society—averaged *over half of the gross national product* of the United States.

Illth comes in many forms. One is conspicuous consumption by the very rich—the luxury cars, yachts, private jets, huge houses, and other forms of ostentatious living. World Bank economists calculate that the wealthiest 10 percent of the world's population uses close to 60 percent of all the world's resources. If this richest 10 percent reduced their consumption to the average consumption of the rest of humanity, total global resource use would be cut in half.[88] The *New York Times* estimated the amount spent on luxury items in the United States in 2012—leaving out the luxury homes—at $302 billion.[89] A 2015 report by the British charity Oxfam found that the wealthiest 10 percent were responsible for half of all emissions of greenhouse gases, whereas the poorest half of the world's people were responsible for about 10 percent.[90]

The prison-industrial complex, expanded primarily due to the racist "war on drugs," and developed in large part to control communities of color, is most certainly illth.[91] Essentially all the enormous economic financial sector does is find ways to make money with money, providing little of social value. The same can be said for marketing, advertising, and packaging for brand promotion and the proliferation of products designed with built-in obsolescence or to stimulate new wants.

The system of giant multinational supermarket companies controlling food supply and sales produces vast quantities of wasted food. It is estimated that between 30 and 50 percent of the food grown in the United States goes to waste.[92] Food is left in the field if it doesn't meet certain cosmetic standards of large buyers, even if it is perfectly good quality. Supermarkets routinely overstock their produce shelves in deliberate displays of abundance, knowing that a portion will spoil and be thrown away. Globally, about one-third of food is wasted, amounting to about 1.8 billion tons and worth approximately $1 trillion.[93] All of this wasted food

means wasted water, labor power, energy, and all the other resources that went into making it—petrochemicals for pesticide and fertilizer production, energy to run agricultural machinery and transportation to markets, and so forth.

The vast majority of food waste is due to an agricultural and food system set up to generate profit. However, a lack of storage infrastructure in the Global South is a major cause of spoilage and pest infestation before the food reaches markets.

The spread of online shopping was once touted as environmentally more benign than trips to the retail shops, but instead it is adding a new dimension to the waste of resources. According to the *Wall Street Journal*, "Giant warehouses are springing up across the country as surging online sales send retailers scrambling to find space to house products destined for delivery to customers' homes."[94] The huge increase in e-commerce deliveries means corresponding increases in cardboard boxes, the most rapidly growing part of the 35 million tons of containerboard produced in 2015. Transport of the packages from warehouses creates further environmental damage. Ardeshi Faghri, a professor of civil engineering at the University of Delaware, said that a 20 percent increase of various vehicle emissions that was measured was at least partially caused by more deliveries of goods: "Online shopping has not helped the environment…. It has made it worse."[95]

U.S. per capita energy consumption is twice that of the most industrialized European countries despite a similar standard of living.[96] The United States consumes 25 percent of world energy, but it does so almost 50 percent less efficiently than Europe. Clearly, there is ample room for improvement, especially because Europe is not particularly energy-efficient in the first place.

Waste is also a routine by-product of capitalists' tendency to overbuild capacity in good times, assuming that growth will continue at its same trajectory. The company that overbuilds capacity eventually comes up against a much lower cost producer or mistaken market possibilities or a recession, leading to abandoned factories and stores that are then repurposed, torn down, or just left to decay. Abandoned or torn-down facilities such as steel mills, clothing factories, movie theaters, and malls represent a huge waste of resources.[97] In many cases it makes no social or

environmental sense to abandon or tear down such properties, but it becomes a reasonable thing to do in an economy in which decisions are made on whether more profits can be made by abandoning a facility than by repurposing the building or constructing a new one.

The same occurs with homes. Tear-downs are common in middle-class and wealthy neighborhoods. A *Wall Street Journal* article titled "Multimillion-Dollar Homes Face the Wrecking Ball" describes a fourteen-bedroom house being purchased for $11.5 million and the empty lot marketed three years later, after the house was torn down, for $14 million. According to the article, "It's almost becoming routine: eight-figure listings treated as tear-downs—and marketed as such. Buyers see value in the land, especially in exclusive neighborhoods or on the waterfront. There, they can build brand-new homes with modern design and cutting-edge technology."[98] In other areas, whole working-class neighborhoods have been torn down and residents dispersed in order to build highways through cities or advance urban "renewal" to gentrify or commercialize a district.

During the rapid growth in international trade in the early 2010s, large numbers of ships were constructed to haul raw materials as well as parts and finished goods. But with the decline in global economic growth in the middle of the decade, scrapping the ships became common. "About 1,000 ships that have the combined capacity to haul 52 million metric tons of cargo will be dragged onto beaches, cut into pieces and sold for scrap metal this year [2016]. That is second only to the record amount of capacity of 61 million so-called dead-weight tons that were scrapped and recycled in 2012."[99] While at least the steel is being recycled, the buildup of shipping overcapacity that ends with ships on the scrap heap when shipping prices plunge during a slowdown is a colossal waste of material and human resources.

In addition to all the other sources of waste we've discussed, the military needs to be acknowledged as a sinkhole into which large amounts of resources disappear. One example is the Obama administration's $1 trillion plan to "modernize" U.S. nuclear weapons and the introduction of the most expensive weapons project in history, the F-35 fighter jet. This plane became notorious for escalating costs and failed tests. "With an American fleet of more than 2,400 planes planned by the late 2030s—projected total costs will exceed $1 trillion. One billion dollars will be

needed just to pay for the highly advanced pilot helmets, running to $400,000 apiece."[100] Imagine what might be able to be done to repair U.S. public schools if $2 trillion (the cost of the F-35 and nuclear weapon "modernization") was used to create healthy and pleasant places for children to learn. The $178 million cost of just one of the planes is enough to provide 3,358 years of college money.[101]

And though the human costs of the U.S.-led wars in Iraq and Afghanistan in the early decades of the twenty-first century are horrendous, the financial costs run into the trillions of dollars—money that could have done much good if spent on social programs in the United States and abroad.

The military also wastes incredible quantities of fuel. It is exempt from all international climate agreements and local environmental regulations at its hundreds of bases worldwide, allowing the U.S. military to be the single largest institutional user of fossil fuels and by far the world's biggest polluter. A full 80 percent of the energy consumption of the federal government is for the operation of the Department of Defense.[102] According to the CIA's *World Factbook*, in 2006 only thirty-five countries used more oil per day than the Pentagon. The U.S. war in Iraq emitted more CO_2 each year than 60 percent of all countries on the planet *combined*.[103] Even within the military, a voluminous budget of almost $1 trillion and guaranteed cost-plus contracts facilitate gargantuan waste, such as the $385 billion for military contractors for U.S. overseas bases over a twelve-year period.[104]

Efforts to Remediate Environmental Consequences

Under capitalism, efforts to ameliorate or reverse the damage caused by ecological rifts and disturbances all have a common element: the underlying cause of the problem cannot be questioned. Whether it is water pollution, soil erosion, ruptures in nutrient cycles, or unsustainable extraction rates of an otherwise renewable resource, the problem is treated in isolation from its context and by technocratic means: We've contaminated the water, so let's bury it underground. Nutrients are stripped from agricultural soils—add synthetic fertilizer. Pests abound—bring on the pesticides. And so on. The solution then often magnifies the original problem or creates a new one:

wastewater disposal from fracking operations leads to earthquakes and contamination of aquifers; excessive use of fertilizers (if some is good, a little more must be better) causes runoff and algal blooms; pests evolve and more pesticides are needed, and so on. Remediation must be done in a way that does not fetter business but allows it to make as much profit as possible. So the original cause of the ecological rifts and disturbances—namely, the inability of capitalism to rationally regulate human interaction with the biosphere in ways that regenerate and maintain a healthy ecosystem—cannot be solved. Short-term, reductionist, and reactive technological fixes inevitably lead to new problems that widen the metabolic rift between humans and the rest of the nature.

Individual Responsibility and the Rise of Recycling

It clearly makes sense to recycle materials rather than to send them to a landfill. In our society, however, recycling serves an important ideological function by convincing people that they're doing something positive for the environment while obscuring the question of why so many products are purposely designed for single use or ready disposal. This perspective puts the responsibility of waste on the individual, not on the company or the system as a whole.

A market-based approach to recycling is also subject to the vagaries of the market. In order for such recycling to work, basic commodities such as metals, paper, and plastics must command a high enough price to be profitable. When the global economy slows, depressing the cost of oil, metal ores, and paper, it becomes cheaper for the makers of water bottles, yogurt containers, and paper products to simply buy new feedstock, making the recycling industry unprofitable:

> In Montgomery, Alabama, Infinitus Energy opened a $35 million recycling center in 2014. By last October [2015], it was hemorrhaging money and shut down. Montgomery's recyclables are now going to a landfill, and a once booming local business, United Plastic Recycling, filed for bankruptcy last year…. Over the last three quarters, revenues from recycling operations [for Waste

> Management, the biggest recycler in the country] are down 16 percent from the same time a year earlier, to $878 million from just over $1 billion.[105]

Used electronics, or "e-waste," is the fastest-growing stream of waste. As the lifetime of electronic products continues to shorten, more and more waste is generated. Recycling and disposal of e-waste is often toxic to humans, animals, and the environment. Many of the processes used to dispose and recycle e-waste are unsafe, releasing toxic emissions into the air and leaching heavy metals into the earth and water supplies. E-waste is most often exported from Europe and North America to developing countries. It was recently discovered that one in three shipping containers leaving the EU contains illegal e-waste. According to a spokesperson for Interpol, the agency tasked with checking the shipments:

> Much is falsely classified as "used goods," although in reality it is non-functional. It is often diverted to the black market and disguised as used goods to avoid the costs associated with legitimate recycling…. A substantial proportion of e-waste exports go to countries outside Europe, including West African countries. Treatment in these countries usually occurs in the informal sector, causing significant environmental pollution and health risks for local populations.[106]

Regardless of whether recycling makes money, can a focus on the behavior of the end user—via lifestyle changes or consumer preferences—really result in significant declines in environmental ills? The answer is an unequivocal no. Real consumer sovereignty is largely fictional under capitalism and, where relevant, only applies to the very rich, who have enough income to do most of the buying. As for corporations, CEOs do not sit around waiting for demand to materialize. They actively manipulate and stimulate it through advertising and the most profitable manufacturing methods. As Ian Angus and Simon Butler point out in *Too Many People?*, the vast majority of people have no choice in the matter: "The range of choices available to buyers is determined not by what is environmentally friendly, but by what can be sold profitably. As a result, we get micro-

choices such as Ford vs Hyundai—but not real choices such as automobiles vs reliable and affordable public transit."[107]

Buying "greener" products with less packaging is little help because the biggest producers of waste are industry and agriculture, not individuals. EPA data shows that in 2013 individuals generated some 250 million tons of municipal solid waste.[108] However, this source represents only about 3 percent of the total solid waste generated in the United States.[109] The remainder comes from extractive industries such as mining, industrial production, and agriculture. The EPA estimated in 1992 that waste from industrial, mining, extractive, and agricultural production was 12 billion tons.[110] So even if all municipal solid waste could be recycled (instead of the usual 15 to 30 percent in the United States), it would barely make a dent in the vast mountains of waste generated by production. Thus, directing efforts to change consumption habits instead of production will not solve the problem. Even when industry does decide to take notice of the pollution it causes, "companies respond most strongly to consumer pressures by reducing their releases to air and transfers of wastes off-site, but also by increasing less visible releases to subsoil via underground injection."[111] Out of sight, out of mind.

By making individual persons the solution to waste, we become the very thing capitalists want: consumers. Conscious and concerned or otherwise, it doesn't matter. Efforts to change consumption habits instead of production will not solve the problem. As Samantha McBride writes:

> What we have for producers is freedom: freedom to be green or semi-green or not green, freedom to do what is in their best interests, without strife or inconvenience. What we have for citizens are (1) a definition of their scope of political action as not just personal behavior, but the purchase transaction, and (2) an utter lack of knowledge needed to reenter the realm of the political and advocate for regulatory change.[112]

Stressing individual responsibility of ordinary people leads us to ignore the waste associated with production. It also ignores the waste associated with consumption by the very wealthy, the military-industrial complex, the vast incarceration system, and the advertising industry. It leads us to

disregard that companies will always be striving to sell more products year after year.

Regulation: Always Inadequate, Never Permanent

Pollution can be moderated to a certain extent through laws and regulations. However, as a testament to how inadequate this is at ameliorating pollution, the overall situation is now far worse than it has ever been. Even when there are regulations, they are usually not stringent enough. As *New York Times* columnist Nicholas Kristof explains with respect to the chemical industry:

> The United States is a laggard because of the power of the chemical lobby. Chemical safety legislation now before the Senate would require the Environmental Protection Agency to start a safety assessment of only 25 chemicals in the first five years—and House legislation isn't much better…. The chemical lobby spent the equivalent of $121,000 per member of Congress last year [2014], so expect chemical companies to enjoy strong quarterly profits, more boys to be born with hypospadias and more women to die unnecessarily of breast cancer.[113]

Even when public pressure forces action against the most egregious and life-threatening pollution, corporate power seeks to water down legislation and weaken laws. With the collusion of state regulatory agencies or through budget cuts, environmental regulations are often minimally enforced. The extent of positive environmental and social changes over time depends on the relative political power of different classes and movements as well as political changes in the wider society.

In the 1960s and 1970s, social movements in the United States and elsewhere successfully fought for a range of beneficial changes to civil, political, and environmental laws. In the decades since, corporate leaders and business groups have lobbied and fought to overturn and limit any regulations and return to the status quo ante. In June 2015, the Supreme Court overturned an EPA regulation that set limits on mercury, arsenic, and acid gas emissions by coal-fired power plants. Had the limits been enforced, they could have prevented an estimated 11,000 premature deaths and

130,000 asthma cases annually. The Court maintained that the EPA had not adequately taken into account the costs of the regulation to the companies.[114]

When backed into a corner by social pressure, capitalists and their ideologues dream up counternarratives to make their case against enforced regulation: the problem will be solved by better, less polluting technology, which is just around the corner; or by market mechanisms; or by changes in consumer choices. One of the stated goals of the Trump administration is to roll back regulations on the environment and to withdraw from the 2015 Paris Climate Change Agreement.

Whenever companies have sufficient political power, they will work to water down or do away with regulations that they think might harm their bottom lines.

Putting a Price on Nature

Perhaps unwittingly stimulated by some academics in the field of ecological economics, the potential monetary value of nature's "services" has taken on a new importance. In 1997, the ecological economics group headed by Robert Costanza estimated that global "ecosystem services" were worth $33 trillion annually, compared with a global economy of $18 trillion.[115] An update in 2011 put the dollar value of the world's annual "ecosystem services" at $125 trillion.[116] Global GDP in the same year was estimated at approximately $70 trillion, making the monetary value of nature's "services" about 80 percent *larger* than all human economic activity.

The assumption that a dollar value can be assigned to nature's "services"—to plants that help clean the air, to marshes and mangrove swamps that protect coastal areas from stormy seas, to wetlands that slow down and clean flowing water, and so on—is a logical outgrowth of a capitalist worldview. Thus, nature as "natural capital" can be subjected to cost-benefit analysis, and schemes can be developed to "offset" any damage that results from a company's practices. This is what lies behind the UN's pollution-offset program, REDD (Reducing Emissions from Deforestation and Forest Degradation Program).

Here's how one offset scheme works. A giant food processing plant discharges large quantities of nutrients into the local waterway. Cleaning up the discharge would require retooling, and that would cut into the company's profits. Instead, the company buys "right-to-pollute" credits on the market, paying some other enterprise, commonly a farm, to pollute less. The outcome is, as Food and Water Watch notes, "a regulatory avoidance scheme fraught with unaccountability that is destined to destroy waterways and communities."[117] Unsurprisingly, REDD and other similar programs have encountered widespread resistance from indigenous organizations and environmental groups.

Dieter Helm, chair of Britain's Natural Capital Committee, maintains that the "environment is part of the economy and needs to be properly integrated into it so that growth opportunities will not be missed."[118] The capitalist views the environment as just one part of the economy instead of viewing the economy as embedded in the environment, a more rational outlook. But as Andrew Simms, environmentalist and researcher at England's Centre for Global Political Economy, points out: "The paradox of environmental economics is that we feel compelled to price nature to make its loss visible on the balance sheet, but in doing so we legitimise its commodification and validate its critical overconsumption in an unbounded market system."[119] Nature as profit-making opportunity provides the ideological sanctification to privatize even more of Earth's natural resources and the commons.

Neoliberalism has achieved an incredible stranglehold on our thinking in recent decades. Even people who genuinely care about the environment have started to believe that market-based solutions like pollution offsets and carbon trading offer a better solution than government regulation and enforcement. But market mechanisms to reduce pollution have nearly always failed. They normally end up as another scam, ripe for stock market gambling. And since capitalism has been unable to solve smaller problems of pollution, environmental degradation, and loss of biodiversity, there is no evidence that the people who run the system will step in to solve the much larger problem of climate change. As George Lakoff, professor of cognitive science, observes, as soon as you monetize something in nature, nature always loses.[120]

A War Against Climate Change?

Many environmentalists hold out hope that climate change will be the issue that finally puts us all in the same boat. Bill McKibben, a leading activist and spokesman for the climate movement, makes this point in his article "A World at War."[121] McKibben is right to argue that the climate crisis has reached a critical juncture and only a massive mobilization of people and resources can change the atmospheric greenhouse gas trajectory. But by his analysis, we are "facing a common enemy" and the only comparable analogy of what is required is the effort by the United States during the Second World War. This entailed retooling production and using government planning to redirect the entire economy toward warfare and military victory over Germany, Italy, and Japan. Now, instead of guns, planes, and tanks, U.S. corporations should be redirected to build the hundreds of new factories required to produce the millions of solar panels, wind turbines, and electric vehicles needed for a carbon-free economy.

But are we really all on the same side? And if we're at war, who are we at war with and what's the strategic objective? According to McKibben, the problem is carbon and the laws of physics: "The question is not, are we in a world war? The question is, will we fight back? And if we do, can we actually defeat an enemy as powerful and inexorable as the laws of physics?"

McKibben continues: "Carbon [dioxide] and methane are seizing physical territory, sowing havoc and panic, racking up casualties…. In this war that we're in—the war that physics is fighting hard, and that we aren't —winning slowly is exactly the same as losing."

Are the laws of physics really somehow malicious? Is nature possessed with a desire to punish, exploit, and oppress? And are we really all in this together, as McKibben implies? With physics and carbon as the enemy, this lets capitalism and its enablers—the real culprits—completely off the hook.

McKibben is using rhetorical devices that he hopes will shock people and mobilize them to action. He, of course, knows full well that physics is not fighting a war against us. Nor is chemistry or biology, for that matter, although our bodies are contaminated with exotic chemicals and species are disappearing overnight. Science is not our foe, and McKibben knows this. The problem he avoids is the way capitalism functions at its most basic

level. Capitalists cannot take into account the consequences of their actions (the “externalities”) in their pursuit of profits. As long as there is no interference with the accumulation of capital, emitted pollutants (and how they behave according to scientific laws) are viewed by capital as irrelevant to the operation of companies. Actually, they are not considered at all unless strong government regulations exist and are enforced.

If the utilization of resources were decided upon rationally, rather than according to the laws of capitalism, unconventional sources of fossil fuels such as tar sands and fracked gas would never have been developed. Considering how abundant sun and wind power are, and how much we now know about harnessing those forms of energy, and with the additional formidable potential of energy from tidal power, society would long ago have made the move toward renewable energy sources. But in the normal operation of capitalism there is no room for rational social and ecological decision-making. Industries and technologies are developed—*and must be developed*—without concern for potential environmental harm.

As might be expected, some companies do much more harm than others. An August 2016 article in the journal *Science*, referring to earlier research, points out which human entities are most responsible for greenhouse gas emissions:

> Heede’s research shows that nearly two-thirds of anthropogenic carbon emissions originated in just 90 companies and government-run industries. Among them, the top eight companies—ranked according to annual and cumulative emissions—account for 20 percent of world carbon emissions from fossil fuels and cement production since the Industrial Revolution.[122]

So why not just stop these companies from operating and promote the building of a clean energy system? There is no evidence that governments will discipline giant corporations and shift the global economy away from fossil fuels. To do so would require drastic downsizing or liquidation of many of the largest corporations on the planet. It would leave Wall Street in tatters. It would also require a huge investment to build a replacement consisting of renewable energy infrastructure. While costs for solar (PV) and wind energy installations have dropped drastically, and in some cases

are cost competitive with new fossil fuel installations, it is wishful thinking of the most utopian kind to expect that capitalists and governments will allow public financing for an effort to replace existing electric power facilities. It is only when the elite feel a direct and immediate threat to their system of capital accumulation, such as a major war or civil insurrection, that they are willing to commit the vast amount of financial resources necessary and agree to have production directed by government.

We face a choice between keeping the old fossil-fuel based infrastructure that is burning up the planet or transitioning, at much lower economic, environmental, and social cost, to a new energy paradigm. Despite the rationale for such a transition, capitalism still won't make the change quick enough. Energy analyst Chris Nelder's figures and argument, framed within the limits of the system, are worth noting:

> Instead of incremental spending on an effectively dead transportation regime, we should be thinking about one that can survive the challenges ahead, and deliver more economic benefits than costs. We should be setting an ambitious target, like replacing all commercial passenger air flights with high-speed rail for trips under 1,000 miles, replacing 90 percent of our city street traffic with light rail, and moving all long-haul freight traffic to rail. Even if the cost of all that rail infrastructure were in the range of $3 trillion, it would be a fantastic investment.
>
> Against $6 trillion (minimum) in sunk costs and $1.6 trillion per year in maintenance, the $1.2 trillion per year estimate I offered in my article on infrastructure, plus building the high-speed rail network at a generous estimate of $1 trillion, looks very reasonable. Put another way: Would you rather spend another $32 trillion over the next 20 years just to maintain our outmoded, unscalable, aged, unhealthy system, plus another $2.8 trillion in lost productivity due to delays and gridlock, only to wind up out of gas? Or would you rather spend $25 trillion to repair our existing infrastructure, transition transportation to rail, transition the power grid to renewables, upgrade the entire grid, and solve the carbon problem, to have free fuel forever?[123]

As these examples illustrate, societal choices are not rational decisions about which technology works best in an objective sense of providing a better, safer, and more comfortable life for all. Rather, the choices conform to the political, military, financial, and ideological priorities of ruling elites.

There is another problem with the world war analogy for taking on climate change: Do we only want to change the source of our energy? Is that enough? But all the other environmental crises and social inequities would remain. In addition, if "we" somehow happened to win the war against the laws of physics and the power of fossil fuel interests, perhaps the same thing would happen that occurred after the Second World War—a rebirth and expansion of a newly invigorated and tooled-up hypercapitalism reasserting power over workers and the planet. Would we then need another world war to deal with new externalities?

Profits from Pollution

Although some capitalists may be hurt by climate change, others will actually benefit. Indeed, some are already busy figuring out ways to make money from it. To Wall Street, which sorts risk by its ability to maximize profit, "adaptation" to climate change simply means learning how to profit from it. And there are a variety of ways of doing so—for example, rebuilding after flooding offers a boost for the construction industry as does the building of coastal defenses against rising seas, already occurring along the East Coast of the United States. Miami is spending $400 million for pumps and other infrastructure to prevent flooding. Hoboken, New Jersey, received a $230 million federal grant to shore up protections, and Norfolk, Virginia, received $100 million from the federal government to carry out a plan to protect neighborhoods from flooding.[124] All of this spending adds to the measured national economic growth (GDP) and thus is seen as positive —even when the reason is negative.

The financial system also provides ways to profit from climate change. As David Ravensbergen writes:

> Even as extreme weather wreaks havoc on crop yields and threatens coastlines, new custom-made financial instruments offer the savvy

> investor the chance to profit from destruction. Weather derivatives offer both a profitable investment today and an insurance policy against future damages by flooding or drought. While the estimated costs of climate change continue to climb, the profits to be made by betting on those costs keep growing faster.
>
> In effect, what we have is a situation in which investors are busy betting on what's going to happen with the climate. Depending on how they invest, they can make money if things get worse or if they get better. If they pick the wrong horse, their bad investments can also be insured by purchasing still more derivatives.[125]

One of the growing areas of financial speculation is the issuance and trading of so-called catastrophe bonds, referred to as cat bonds, offering insurance against catastrophic weather events as well as other types of disasters such as wildfires.[126] The $72 billion in cat bonds in 2016 is expected to double in the next few years.

An economic system that has the pursuit of profits as its primary motivating force is anti-environmental at its very core and cannot be made "green." There is no mechanism by which a capitalist society can thoughtfully plan and carry out the rational human interaction with the rest of the natural world. Production of illth will continue as long as capitalism continues, in the form of weapons, overproduction, the prison and (in)justice system, luxury consumption (including McMansions), commodities without a social purpose, and products that easily break or are quickly outdated. The misuse of natural resources will also continue as will the loss of biodiversity and the contamination of the biosphere with toxins.

4

Capitalism's Effects on People

> One day we must ask the question, "Why are there forty million poor people in America?" And when you ask that question, you are raising a question about the economic system, about a broader distribution of wealth. When you ask that question, you begin to question the capitalistic economy…. And you see, my friends, when you deal with this you begin to ask the question, "Who owns the oil?" You begin to ask the question, "Who owns the iron ore?" You begin to ask the question, "Why is it that people have to pay water bills in a world that's two-thirds water?"
>
> —Martin Luther King Jr.[1]

Detrimental effects on people are built into the structure of capitalism, causing psychological and physical harm. How someone experiences the system's effects is different, depending on where a person lives, one's gender, sexual orientation, class or caste, perceived "race," religion, nationality and mental or physical disabilities. But each of us falls into more than one of these categories, complicating the story. For example, effects of this society on African American working class women are different from those on white working class women and different from white wealthy women. While acknowledging and highlighting this complexity and the interaction of different forms of oppression and how they are experienced, we will discuss them separately in order to clarify the major effects on people as workers, those subject to racism, sexism, native peoples in colonial settler countries, and as people living in countries subjected to wars fought by leading capitalist countries for geopolitical or economic control.

Effects on Workers

The vast majority of people in capitalist countries need to work to make a living and are, by definition, subordinate to those that own and run businesses, the capitalist class and its hired managers. A fundamental impact of the system is alienation from one's own labor and from nature. In addition, the threat and reality of unemployment, and for those earning low income or without jobs and living in poverty.

The Alienation of Labor

One central effect of capitalism—on all working people—is the lack of control over one's own labor. Our labor power transforms nature's resources into the wherewithal of our daily lives: we make tools, we gather or grow food, and we build shelters. In this we are little different from a number of other animals. But, unlike other animals, we act on resources *consciously*. And our ability to carry out free, conscious, and creative work is an inherent part of our humanity. But those who work for a living, as the vast majority must do in capitalist societies, have no say over what is produced, how it is produced, or what becomes of it afterward. Capitalists or corporate managers, utilizing the "logic of the market," decide all of these questions. Our labor, so central to our life activity, ceases to be our own creation and becomes instead "a mere means to [our] *existence*."[2]

Alienation from our own labor is not only or even primarily a psychological condition, but a feature integral to capitalist social relations, one that profoundly damages us. The repetitive, often pointless monotony of most work, the jobs in which people spend a large part of their waking hours, "is a … stifling of one's urge to self-fulfillment in the most important segment of one's life, the spending of vital energies at tasks one would never dream of freely choosing." [3]

Much human unhappiness and dissatisfaction comes from having to work at whatever job we can find that requires making things (including services) for someone else who profits from our labor and over which we have no control. Work, far from being the joyful fulfillment of our lives, becomes its opposite: a nightmare of stress and dissatisfaction as people try

to earn enough money to survive or, in the United States, fulfill the "American Dream" we are cajoled to aspire to. Additional stress comes from the constant need to please the boss for fear of losing one's job or actually becoming unemployed.

The goal of capitalism is to maximize profits, and one of the best ways to achieve this goal is to increase labor productivity by simplifying, routinizing, and automating work tasks so that workers can produce more in ever-shorter amounts of time. Workers who are forced to suppress their own abilities while working continuously at ever-increasing speeds experience both mental and physical exhaustion. Automation and de-skilling is thus one component that feeds into alienation.

The trend toward automation has been present since the earliest days of capitalism, but the newest wave of automation, involving increasingly sophisticated robots and software, has further implications for the future of work, as this 2013 AP study found:

> Year after year, the software that runs computers and an array of other machines and devices becomes more sophisticated and powerful and capable of doing more efficiently tasks that humans have always done. For decades, science fiction warned of a future when we would be architects of our own obsolescence, replaced by our machines; an Associated Press analysis finds that the future has arrived.[4]

In earlier periods, machines were primarily substitutes for the performance of relatively simple manual tasks. Now, robots and computer algorithms are capable of complex tasks, including many aspects of service and skilled work, and even intellectual work, such as writing reports and news articles and examining X-rays:

> … automation also produces quicker drug development, safer highways, more accurate medical diagnoses, cheaper material goods, and greater energy efficiency, to name just a few of its obvious benefits, [but] there have been a few cautionary voices … urging us to take stock, especially, of the effects of automation on

> our very humanness—what makes us who we are as individuals—and on our humanity—what makes us who we are in aggregate.[5]

What we should really be worried about is the system of capitalism, not robots or our humanity.[6] What has been shown to give people true happiness—control over our own lives and creative and socially meaningful work, participation in community activities, and time with friends and family—has decreased through longer hours at work, less control over the workplace environment, always-on connectivity, more job insecurity, longer commutes to and from work, and an unachievable quest for satisfaction through ownership of consumer goods. (In another type of society automation could provide all people with the necessities of life as well as more leisure time and provide us with the wherewithal and time to engage in cultural, recreational, and craft activities.)

The source of our alienation is the lack of control in the workplace, and the unequal opportunities it affords for financial well-being as well as quality of life. Consumerism is a form of emotional compensation we use in a futile attempt to overcome alienation. Recognizing this can help us begin to constructively deal with our alienation. As Alan Roberts points out in *The Self-Managed Environment*:

> It is that exploited, alienated and relatively powerless period, the working day, which reduces … [people to settle] for commodity satisfaction in their "free time." The bargain … extends its influence throughout all levels and institutions, marking out the shape of the "consumer society." It is this society which threatens the environment with its unlimited appetite—unlimited precisely because its objects are so unsatisfying.[7]

Moralistic appeals against consumption, such as "Buy Nothing Day" or berating ordinary people for wanting an easier life and seeking fulfillment through the acquisition of things they're told they need, miss the heart of the issue. A more helpful approach is to encourage workers to empower themselves in the workplace. More control over the work process and countering attempts to worsen their conditions through constantly changing schedules and speedups or other means to increase exploitation will lead to

workers who begin to see their happiness connected and expressed through better working conditions and engaging with others in the struggle rather than through more consumer goods.

Unemployment

Unemployment, whether temporary or for long periods, is a reality of capitalist economies. There are a significant number of workers who are described as "marginally attached" to the labor force, members of the reserve army of labor described in chapter 2. But even those who are normally employed are affected by the constant loss of jobs as businesses automate, downsize, or go out of business. Many studies have shown that unemployment is dangerous to your health. Heart disease, high blood pressure, and diabetes are more common in the unemployed than among people who have jobs.[8] The psychological impact of not being able to earn a living is especially damaging for a species that gains a sense of fulfillment from productive activity and must obtain and manipulate what we need from the external world in order to stay alive, healthy, and happy. In a study across sixty-three countries, researchers estimated that approximately 20 percent of suicides were the result of unemployment.[9]

And when unemployment overtakes whole neighborhoods or cities things get even worse. Workers and communities are devastated when corporations pull out, as they have done since the 1970s with the deindustrialization of the so-called Rust Belt, or automate and reduce their labor needs, as with coal mining in Appalachia. High levels of unemployment end in marginalization and hopelessness in white communities and those of color.

The playwright Lynn Nottage interviewed people in Reading, Pennsylvania, hit hard by closures of steel and textile factories, gathering material for her play *Sweat*, which opened in 2015. In an interview in *Fortune*, Nottage observed the similarities between devastated white and African American communities: "When I sat in rooms with middle-aged white men, I heard them speaking like young black men … they were feeling angry, disaffected, and in some cases, they actually had tears in their eyes."[10]

There are never plans for new jobs for displaced workers or more than perfunctory assistance when large-scale job losses occur. People and the communities are left to fend for themselves, leading to generations that are "angry, disaffected," and living without hope for better lives.

The Corroding Effects of Poverty

In 1770, the English poet Oliver Goldsmith wrote of the land enclosures and deserted villages "where wealth accumulates, and men decay." Poverty and great wealth go hand-in-hand in capitalist economies. Regardless of how quickly or by what amount the economy grows, inequality is essential to the successful operation of the system, with poverty normally present.

In class societies there have always been people at the bottom, living a more difficult existence than those in the upper strata. But what is it about capitalism that poverty persists no matter how much wealth accumulates? In the United States, the perpetual lack of jobs for those wanting to work, weak unions, an elite that refuses to pay their fair share of taxes, and a blame-the-victim ideology all combine to maintain poverty as an accepted reality.

In the United States, the "land of plenty," about 43 million people have incomes below the poverty line, most living in households considered to be "food insecure." Migrant workers who harvest much of the country's fruit and vegetables can't afford to buy the crops they harvest.[11] Half of the poor live in families with a working head of household—working, but not earning enough to lift them out of poverty.[12] In addition to those living in poverty, another 56 million are classified as "low income," but not poor. This means that about one-third of the population (around 100 million people) live in families that are, at best, one paycheck away from economic crisis.

As any poor person knows, it's expensive to be poor, making it even more difficult to live. Poor people are taken advantage of in numerous ways and pay more than the better-off for almost everything: services and food, auto insurance, borrowing money, cashing paychecks.[13] Poor neighborhoods are often "food deserts": fresh produce and nutritious food is commonly unavailable, and nearby stores charge higher prices than elsewhere.

Housing is another major issue, as Harvard sociologist Matthew Despond points out:

> Landlords … aren't making money in trailer parks or ghettos in spite of their poverty but because of it. Depressed property values offer lower mortgage payments and tax bills. In poor areas of the cities, rents are lower, too—but not by much…. Landlords renting to poor families can charge slightly reduced rents but, owing to far lower expenses, still command handsome profits…. Poor families are stuck. Because they are already at the bottom of the market, they can't get cheaper housing unless they uproot their lives, quit their jobs and leave the city.[14]

Poverty is a cause of illness and early death as well as a barrier to receiving needed health care. According to pediatrician Tom Boyce at the University of California at San Francisco, "Socioeconomic status is the most powerful predictor of disease, disorder, injury and mortality we have."[15] Malnutrition, exposure to toxins, psychological stress associated with being poor, lack of regular access to health care, and not being able to afford prescribed medicines all contribute to ill health. Conditions of poverty may drive people to borrow money, hoping to do better and pay back the debt. But this can also lead to even greater problems. For example, farmer suicides in portions of India, resulting from debt peonage that they cannot escape, have reached epidemic proportions.[16]

Poverty and unemployment are endemic to capitalism and have severe human repercussions, with many living short and stunted lives because of the conditions created by the normal functioning of capitalist economics.

Racism

One way that capitalism's elites maintain their power is by fostering divisions throughout society. These social divisions are not accidents. They act to prevent people from uniting, to keep them fighting to stay one rung higher up the ladder by stepping on those below. That is why racism and the systematic oppression of women are endemic to capitalist societies, varying only by degree. They encourage groups to align their interests with the

ruling elite rather than with the people they work among. They stoke prejudices, which leads to further divisions.

Racism is aimed at a number of groups of people in the United States—especially Americans of African, Native, and Hispanic backgrounds. In this section we'll focus on racism against African American community because of its widespread and insidious nature and the part it plays in the continuation of their suppression since the end of slavery. Today's systemic racism was created and continually reinforced during the development of capitalism. From its early days, white supremacy provided the ideological justification for colonialism and slavery. The people who were subjugated were deemed to be of a different, and inferior, race than their European conquerors.

The United States began as a settler colonial state, forcibly taking the land from its indigenous inhabitants and stealing the labor and lives of enslaved Africans. This double theft, of land and labor, is embedded in the nation's very creation. In two rarely quoted passages of the Declaration of Independence (1776), the founding fathers accuse King George III of thwarting the expansion of settlements farther west into Indian lands and inciting "domestic insurrections" of slaves and "merciless Indian Savages" against the settlers.[17] It is more widely known that slavery was written into the Constitution: enslaved Africans (referred to as "all other Persons") were counted as three-fifths of a person, for purposes of calculating the number of representatives to Congress from the slaveholding states.[18]

To a significant extent there is a zero-sum game in capitalist societies and economies: if someone wins, someone else loses. The system functions in such a way that there is a scarcity of jobs, let alone well-paying ones, and spots in college for everyone who wants to attend. Thus when a person of color gets ahead, they are perceived by some as intruders "cutting in line" to attain the good life. This helps to explain how a significant number of whites have come to believe that discrimination against them is a bigger problem than discrimination against African Americans, despite all evidence to the contrary.[19]

The overt racism of Donald Trump's presidential campaign made it abundantly clear that systematic racism continues to be a central force in the United States. It is pervasive and, as sociologist David R. Williams explains, even "normal":

> As an American raised in this society with negative implicit biases against black people, you are not a bad person. You are simply a normal American. We have to come to grips with the reality that this racism is so deeply embedded in our culture that it shapes how we see the world, it shapes our beliefs, our behavior, our actions toward members of other groups.[20]

However, racism is much larger and deeper than individual whites harboring racist attitudes. By carving out some parts of the population and portraying them as different, inferior, and less worthy, businesses and governments can keep labor divided against itself.

With respect to how racism shapes our actions at the systemic level, in *The New Jim Crow*, Michelle Alexander contends that the U.S. criminal justice system operates in a way that inevitably leads to social divisions and disproportionate incarceration rates based on race.[21] People of color are incarcerated at much higher rates than whites; it is part of the system of racial violence that has been instituted throughout U.S. history. The system is set up so that racism is an unavoidable and entirely predictable outcome.

The U.S. criminal justice system is a "growth industry" and the U.S. is the world leader in incarceration. According to a 2015 report by the Sentencing Project, there are "2.2 million people currently in the nation's prisons and jails—a 500% increase over the last forty years. Changes in sentencing law and policy, not changes in crime rates, explain most of this increase." The report indicates that 67 percent of the prison population is composed of people of color, whereas they make up 37 percent of the overall U.S. population. The report also outlines that more than anything else, it is racist sentencing policies, implicit racial bias, and socioeconomic inequity that accounts for these figures.[22]

The past few years have given us a spate of high-profile incidences of police targeting and killing of mostly unarmed black people in the pursuit of "justice": in 2014, Eric Garner in Staten Island, New York was killed for selling loose cigarettes; Michael Brown in Ferguson, Missouri, was fatally shot after a verbal confrontation with an officer; Laquan McDonald in Chicago, Illinois was shot sixteen times for allegedly carrying a knife; and Tamir Rice in Cleveland, Ohio, was killed while playing with a toy gun. In 2015, Walter Scott in North Charleston, South Carolina, was pulled over for

a broken brake light; Freddie Gray in Baltimore, Maryland, was arrested for carrying a knife and put into the back of a police van unrestrained yet handcuffed, which resulted in fatal injuries to his neck and spine; Sandra Bland in Prairie View, Texas, was arrested after a traffic stop and allegedly committed suicide in her cell. In 2016, there was Alton Sterling in Baton Rouge, Louisiana, who was killed after being falsely accused of carrying a gun; Philando Castile in Falcon Heights, Minnesota, was killed for driving while black.

By no means were these cases exceptional. According to the site mappingpoliceviolence.org, police killed more than 100 unarmed black people in 2015, at more than five times the rate of unarmed whites. In most if not all of these incidents, their deaths go unpunished.

In 2014, when a white police officer shot and killed an eighteen-year-old black teenager, Michael Brown, and left his body lying in the street in Ferguson, Missouri, the country erupted in street protests and anti-racist organizing. A subsequent Justice Department inquiry into the Ferguson police department revealed that African Americans constituted 70 percent of the city's population, but 85 percent of those had been stopped in their cars, 90 percent of those given citations, and 93 percent of those arrested. An investigation by *USA Today* found that over 1,500 police departments around the country arrest African Americans at even higher rates than in Ferguson.[23]

The Justice Department investigation into the Ferguson police department revealed that the city was augmenting its revenue stream through "aggressive enforcement of Ferguson's municipal code."[24] According to U.S. attorney general Eric Holder Jr., the police and court system were "primed for maximizing revenue."[25] Political scientist Henry Farrell phrased it more bluntly. He wrote that the Department of Justice report "depicts a system in Ferguson that is much closer to a racket aimed at squeezing revenue out of its population than a properly working democracy."[26]

What happened in Ferguson is happening all over the country. National and state funding to local municipalities has been steadily cut over the last forty years as taxes on the rich and corporations have been systematically reduced. As a result, cash-strapped cities and municipalities attempt to make up for revenue shortfalls by issuing fines for minor infractions, often

to those least able to negotiate the court system and least able to pay. Using traffic stops and ticketing, the police often act like an armed and violent state-run collection agency. Numerous fees are added to a person's fine, escalating the amount owed and making it even more difficult to pay.

Although federal imprisonment for unpaid debt has been illegal in the United States since 1833, and is specifically barred by the U.S. Constitution, it is now common practice in a third of U.S. states. A report by the American Civil Liberties Union showed that people were jailed even when the cost of imprisoning them was greater than the amount of the original debt.[27] Jail time can sometimes mean loss of a job or housing, and in some cases, like that of Sandra Bland, it means death.[28]

Of all the outrageous incidences of racial violence committed by police in the recent past, what was revealed in Chicago is perhaps the most shocking. The city has a long history of racially abusive policing and holding suspects in secret sites where torture was common. Cook County Commissioner Richard Boykin likened the tactics used at Homan Square—one of the secret "black sites" uncovered in 2014—to the Gestapo.[29] "Violence and the use of illicit violence against people of color, particularly African Americans and Latinos, is as routine in Chicago as traffic lights," observed lifelong civil rights activist Prexy Nesbitt, himself a victim of police abuse as a teenager.[30] Some indication of the extent and severity of police brutality in Chicago is that during the last twelve years, the city paid out over a half billion dollars in settlements with victims, money that could have funded "5 new state of the art high schools, 33 new libraries or countless mental health facilities and community development programs."[31]

Government Complicity in Unequal Opportunity

Discrimination is present in almost all government interactions with people of color. Segregated housing kept in place by governments, real estate interests, and banks is one of the many factors that have prevented African Americans from advancing economically. Unsurprisingly, when African Americans are able to move to unsegregated neighborhoods with better resources, their children generally perform better scholastically than those not able to move.[32] But in an editorial that came out after the 2015 killing of

Freddie Gray in Baltimore and the demonstrations that followed, the *New York Times* noted:

> The century-long assault that Baltimore's African Americans have endured at the hands of local, state and federal policy makers, all of whom worked to quarantine African American residents in ghettos, making it difficult even for people of means to move into integrated areas that offered better jobs, schools and lives for their children. This happened in cities all over the country, but the segregationist impulse in Maryland generally was particularly virulent.[33]

But discrimination in housing—"Housing Apartheid, American Style" is the way a *New York Times* editorial put it[34]—is not the only problem with respect to government. As for education, a 2013 report on public schools in the United States found that they were more segregated today than they were forty years ago. It found that "28 percent of African American children live in high-poverty neighborhoods, compared with 4 percent of white children."[35]

In 2013 the U.S. Supreme Court gutted Section 5 of the Voting Rights Act of 1965. This section of the law required certain states and counties with histories of discrimination against African American voters to receive preapproval from the Justice Department for any changes in their voting laws.

The arguments for overturning parts of the Voting Rights Act revolved around three spurious assumptions: that we have transcended the legacy of racism and therefore the federal oversight of voting rights is no longer needed; that there is significant voter fraud (which, for all practical purposes, is nonexistent); and that the new state laws don't especially hurt potential black voters.

Immediately after the Supreme Court decision, eight states passed laws that significantly restrict African American voter access. According to the Brennan Center for Justice, North Carolina's 2013 law is one "of the most restrictive laws since the Jim Crow era."[36] In July 2016 a federal court struck down one of the North Carolina laws, declaring that its provisions deliberately "target African Americans with almost surgical precision."[37] However, regulations making it more difficult for African Americans to

vote in fourteen states during the 2016 elections, including the shortened early voting period and reduced numbers of polling places in North Carolina, may have influenced the outcome.

Additionally, governments have caused and/or prolonged environmental damage in predominantly African American communities. In 2011, after the local economy tanked and jobs were outsourced to more profitable locations, Michigan appointed an "emergency manager" to run the city of Flint, an impoverished city of 140,000 people. The appointed manager ordered the city to disconnect from the Detroit water supply and instead use the polluted Flint River as its water source, saving about $1 million a year. However, more chemicals were needed to purify the dirtier water, resulting in higher levels of organic carcinogens. The extra chemicals also made the water more corrosive, causing lead and copper to leach into the drinking water. As a result, Flint's water contained close to seven times the amount of lead allowed by public health standards.

Despite many complaints from Flint residents, state officials ignored mounting evidence that the river water was corroding the city's old lead pipes and leaching lead into tap water. The number of children with high levels of lead in their blood doubled; rashes and other illnesses developed. If it were not for independent researchers from Virginia Tech, the people of Flint—a city that is 56 percent African American, with high levels of unemployment and widespread poverty—might have remained uninformed about the toxicity of their tap water. Virginia Tech research scientist Marc Edwards testified at subsequent congressional hearings in Washington:

> Agencies that are paid to protect us from lead in water can get away with anything…. It's part *1984* and part *Enemy of the People*. I'm begging you, please: fix the EPA lead and copper rule, and fix the EPA…. The only thing I can conclude is that the EPA doesn't care about children drinking water with lead in it. You'd have to ask them why they don't do the job they are paid to do. Had it not been for people completely outside the system, children in Flint would still be drinking that water today. That is a fact.[38]

Yet Flint was only the tip of the iceberg. "Data collected by the Centers for Disease Control and Prevention shows that over 40 percent of the states

that reported lead test results in 2014 have higher rates of lead poisoning among children than Flint."[39] According to a Natural Resources Defense Council (NRDC) report, some 18 million people in the United States drink water from sources that have violated federal drinking water standards.[40]

Detroit water is once again flowing to Flint. But contamination from the corroded pipes continued to occur into 2017, although at lower levels. The children affected by lead poisoning may well suffer a lifetime of adverse health effects as a result of their exposure.

Racism and Health

People of color are routinely exposed to more environmental toxins, suffer discrimination in the health care system, and are unemployed in greater numbers than whites. The title of an article in *The Nation* put it bluntly, "Race Best Predicts Whether You Live Near Pollution."[41] Coal mines and coal-fired power plants continue to have an immense detrimental impact on water bodies, air quality, and the health of the people who live nearby. The NAACP's "Coal Blooded: Putting Profits Before People" reported that 6 million Americans live within three miles of a coal plant.[42] This makes them prime targets for the variety of toxic pollutants, some of which are neurotoxins, emitted by coal plants. The average per capita income for those 6 million is significantly lower than the U.S. average. Of the 4 million people within three miles of the 75 (out of 378 total) dirtiest, oldest, most polluting coal-fired stations in operation, 53 percent are people of color. Compared to the rest of the population, people of color are more likely to be living near toxic waste sites (56 percent of those living nearby are people of color); twice as likely to live without clean water and modern sanitation facilities; they are thirty-eight times more likely to be exposed to nitrogen dioxide, which causes respiratory problems.[43] Throughout the country, African Americans go to the ER with asthma attacks at nearly *350 percent* the rate for whites.[44]

As discussed above, poverty results in more health problems and lower life expectancy than those more advantaged. However, the health of African Americans is especially damaged by poverty and racism. A 2014 article in *Social Science & Medicine* concluded: "Institutionalized white

socioeconomic resources, discrimination, and racialized framing from centuries of slavery, segregation, and contemporary white oppression severely limit and restrict access of many Americans of color to adequate socioeconomic resources—and to adequate healthcare and health outcomes."[45]

Although the environmental conditions of African Americans are severe, it also is important to note the horrible situation for many Native Americans. The air and water pollution on tribal lands in the United States by uranium and coal mines and coal-fired power plants continue to have an immense detrimental impact on the environment and the health of the people. "It is Native Americans—from Navajo uranium miners to tribal communities targeted with atomic waste dumps—who have borne the brunt of both the front and back ends of the nuclear fuel cycle."[46] In Canada the tar sands are being excavated and partially processed on First Nations land, with toxins such as heavy metals and polycyclic aromatic hydrocarbons (PAHs) contaminating people, wild animals, plants, and water. Furthermore, "these environmental declines contribute to a change in diets as community members shift from healthy country foods to expensive and often nutritionally deficient store-bought foods, a shift that is only accelerated by concerns regarding the quality of and safety regarding locally sourced country foods."[47]

The Ideology of Power: Blame the Victim, "The Other"

Most people up and down the economic ladder become socialized to unequal conditions and the mistreatment of people and see these policies as normal and natural—which they are under capitalism. To ensure that the system itself is not held responsible, politicians, capitalist ideologues, and the corporate media create an alternative explanatory framework. One form this takes is to blame the victim. If only *they* made better choices, they wouldn't be in their situations. Irresponsible personal behavior or lack of motivation is the cause of their troubles. Considering "them" to be "the other" makes it easier to assign blame.

Inherent in the blame-the-victim ideology is the myth of equal opportunity for everyone. If you work hard enough and make the right

choices, you will succeed. But a child conceived and born into poverty, with its associated stresses and limitations, does not have the same opportunities as a child born into wealth. The continuing belief in the falsehood of equal opportunity and the equally false notion of easy upward mobility, as well as the widespread acceptance of racist and sexist ideas, help to explain many people's acquiescence to gross inequalities in society and continuing discrimination. This ideology sanctifies wealth and greed as reward for good behavior and good decisions and helps to explain, as W. E. B. Du Bois wrote, "the fact that so many civilized persons are willing to live in comfort even if the price of this is poverty, ignorance, and disease of the majority of their fellowmen."[48]

Much of the white male chauvinistic and racist ideology that was developed under capitalism casts those of other ethnic backgrounds, religions, other classes, and even women as "the other." They are considered different from, and inferior to, white males, especially wealthy white males. Categorizing so many as "the other" combines with blame-the-victim ideology to make it more acceptable *not* to provide adequate assistance for the poor, the single mother, for African Americans, for Native Americans, for the long-term unemployed, for women suffering oppression, and so on. According to W. E. B. Du Bois, capitalism is the primary cause of systemic inequalities, including racism. This is how Du Bois described being "the other" as an African American:

> It is a peculiar sensation, this double-consciousness, this sense of always looking at one's self through the eyes of others, of measuring one's soul by the tape of a world that looks on in amused contempt and pity. One ever feels his twoness—an American, a Negro; two souls, two thoughts, two unreconciled strivings; two warring ideals in one dark body, whose dogged strength alone keeps it from being torn asunder.[49]

For many, the internalization of this dichotomy can be psychologically damaging and stressful. Many of the struggles for full equality, such as the Black Power movement as well as the contemporary Black Lives Matter movement, have revolved around attempting to re-identify away from the

"twoness" Du Bois described, to being recognized as complete and equal human beings,

> to merge his double self into a better and truer self. In this merging he wishes neither of the older selves to be lost…. He simply wishes to make it possible for a man to be both a Negro and an American, without being cursed and spit upon by his fellows, without having the doors of Opportunity closed roughly in his face … to be a co-worker in the kingdom of culture, to escape both death and isolation, to husband and use his best powers and his latent genius.[50]

The government uses racially coded rhetoric to control the narrative of inequality and guide policy decisions. Think of former president Nixon's "Southern Strategy" of sympathy and support for anti-integration racist whites, President Reagan's chastising of "welfare queens," always accompanied by pictures of African Americans made to appear to be living the high life at public expense. There's also former first lady Hillary Clinton's 1996 reference to a segment of youth as "superpredators … [that have] no conscience, no empathy." These all serve to encourage racist attitudes and make them more respectable. Racist and anti-immigrant policies are prominent in the Republican Party, as was made abundantly clear during a 2016 election campaign that has made open expression of prejudices more acceptable. Anti-immigrant and neo-fascist politicians in Europe such as those of the Golden Dawn in Greece and the National Front in France play a similar role.[51] The 2016 British vote in favor of leaving the EU was partly a result of racist anti-immigrant sentiment.

The force of racism is made even stronger by blaming the victims instead of blaming the system that relies on discrimination to control a portion of the population and does not supply everyone with reasonably paying jobs. The prevalence of racism means that there are feelings not far beneath the surface that can be exploited by right-wing political movements during stressful times.

Oppression of Women

The oppression of women is not unique to capitalism; it goes back to the development of class-structured societies that arose with the transition to agriculture. Beginning about 10,000 years ago, human society began to shift from the general equality of semi-nomadic hunter-gatherers to settlements based on animal husbandry and agriculture. This shift in obtaining food also required a change in social relations, taking different forms in various parts of the world, resulting in oppression of women. The subservience of women occurred in ancient city-states, empires, and in the feudal societies of Europe. (Societal changes brought about by agriculture are discussed in more detail in chapter 6.)

With the rise of capitalism, the relative position of women began to change again. Among free peasants in early modern England, women frequently inherited property to the same extent as men. But in the late 1600s, as the inheritance of property and wealth increasingly became a source of capital accumulation, inheritance by the firstborn male spread from the nobility to the yeomanry and filtered down to the rest of society.

By the mid-1800s, wealthy landowners, using the power of the state to increase their holdings, had enclosed so much common land that most peasant families could no longer graze cows, keep chickens, or plant kitchen gardens. There was little to fall back on in difficult periods, and families were forced to sell their labor for wages in order to survive.

Before the enclosures, peasant women contributed greatly to the subsistence household economy, spinning and weaving cloth, sewing garments, tending kitchen gardens, gathering wild rushes for light, and cresses, nuts, and berries for food. In addition to subsistence contributions and domestic work, including childcare, they also earned income through selling handicrafts and agricultural products.

With the move from a subsistence economy to a wage economy home production of goods was converted to piecework organized by middlemen. They set up workshops or provided home workers with raw materials and skimmed off profits on the finished articles. Women were invariably paid less than men in the new money-wage economy and therefore could not contribute on the same basis as men to the family income.

When the population shifted from rural villages to cities, traditional ways of life and culture were transformed. The extended family of the village was replaced by the nuclear family in the urban center, and women

of all classes found themselves confined in a more rigid system. Men were the “breadwinners”: they controlled the money and the power. Former peasant women (and children) worked in the industrial labor force, but at lower wages than the men. For the middle class, a non-wage-earning wife “at home” became a mark of social class. As they lost economic power, the burden of domestic labor and social reproduction fell mainly on the woman, who also lost the protection they’d had as daughters and sisters living with their families of origin.

Raising and caring for the next generation of workers is critical for the continuation of any society, including capitalist ones. Though this work has very high *use value* to the family and to society, it has no *exchange value*—that is, it does not produce a service or commodity that can be sold for a profit. Hence, this essential and time-consuming “women’s work” is not considered part of the economy, and is therefore not compensated. In 1995, the UN Development Program estimated that women’s unpaid labor—the “invisible contribution of women”—amounted to $11 trillion. This was equivalent in monetary terms to approximately half of the global economy at the time.[52] Relying on unpaid work done primarily by women instead of provided by social programs, means lower taxes on the wealthy and more profits for capitalists.

Simone de Beauvoir once commented that a woman is not born: she is made. This starts early in life and continues into adulthood in myriad ways that encourage and reinforce particular interests and activities.[53] The hypersexualized society we live in—strengthened and encouraged throughout the media with gendered toys, activities, and education, rituals such as beauty pageants, and gendered dress codes and behavior—straitjackets young girls and boys to see themselves as different from each other from birth; the damage and negative ramifications echo through every sphere of life.

Fashion styles that restrict women’s activities such as uncomfortable and unhealthy high-heel shoes have been encouraged by advertising and enforced by convention and competition. The policing and control of women’s bodies is taken to extreme lengths. One of the more absurd examples of fashion constraints is that the wearing of trousers by women was strongly discouraged or forbidden (in U.S. public schools) or actually outlawed. At the height of the French Revolution in October 1789, the

working-class women of Paris marched on Versailles *sans-culottes*, wearing trousers, not skirts. To curtail this dangerous precedent, France passed a law in 1800 barring women from wearing trousers. Although exceptions were made later in the nineteenth century for women riding bicycles and horses, and subsequently not enforced, the law remained on the books until 2013.[54] In the United States there was also the same belief that women wearing pants somehow promoted radical, even revolutionary, actions. In an article titled "The Cult of True Womanhood," Barbara Welter describes a didactic passage that appeared in a women's magazine from the mid-1800s:

> The girl expresses admiration for the bloomer costume—it gives freedom of motion, is healthful and attractive. The "Professor" sets her straight. Trousers, he explains, are "only one of the many manifestations of that wild spirit of socialism and agrarian radicalism which is at present so rife in our land." The young lady recants immediately: "If this dress has any connexion with Fourierism or Socialism, or fanaticism in any shape whatever, I have no disposition to wear it at all … no true woman would so far compromise her delicacy as to espouse, however unwittingly, such a cause."[55]

Restrictions on women's dress may seem like something from the past, but in 2016 a temporary receptionist in London was sent home on her first day on the job. She had worn flat shoes and refused to adhere to the policy that women should wear shoes with 2- to 4-inch heels. This was for a job for which she needed to be on a 9-hour shift and do a lot of walking. "Discriminatory dress codes remain widespread," concluded a 2017 report on the issue of dress codes for women in Britain. The report committee received complaints that women had to "dye their hair blonde," "wear revealing outfits," or "constantly reapply makeup." [56] And on the U.S. side of the Atlantic, President Trump, obsessed with superficial images, apparently wants his female staffers to "dress like a woman." Women who worked in local campaign field offices "felt pressure to wear dresses to impress Trump." [57] (This, of course, pales in significance compared to Trump's self-confessed assaults on women.)

Why so much effort to distinguish men from women and establish such clear gender demarcation that one sex is always treated worse than the other? These also play into the oppression faced by people identifying as LGBTQ who want to express themselves, look and dress however they want. Lack of workplace equality for women and people of color is profitable for business, which can then pay them lower wages. Additionally, there are financial gains to be made by the objectification of women in movies, magazines, and on the web as well as by the sale of differentiated toys for girls and boys rather than simply for all children.

Despite hard-won progress in some areas, a deep-seated and constantly reinforced oppression continues to exist against women. “Differences in biology” is still trotted forth as justification for lesser job opportunities and wages. Women in leadership are frequently criticized for being too bossy or pushy, while men exhibiting the exact same behavior are considered appropriately assertive and ready for promotion. Ingrained stereotypes influence decisions of all kinds.

For example, when women audition for symphony orchestras, they are more likely to be accepted if the selection committee is unaware of their gender. Women software developers are considered better coders than their male counterparts if “their peers didn’t realize the code had been written by a woman.”[58] And students judge a professor teaching an online course more favorably if they think that she is a he. Over a century since the birth of the first concerted movement for women’s rights, with a mere 17 percent of the House of Representatives female, the United States ranks 77th out of 190 countries on gender parity in national parliaments.[59] To break gender inequality down by race would reveal further disparities, as racism alters and reinforces the dynamics of sexism.

Women in the workplace still earn less than their male counterparts, and they are expected to be more submissive and not to ask for increased salaries, while that is an accepted practice for males. They rarely receive paid maternity leave and lack of quality childcare limits the possibilities for many women. They work longer hours in the home—up to *ten times longer*, depending on the country.[60] As a consequence, men’s total work time is two-thirds financially compensated, whereas for women, the figure is only one-third.[61]

Violence against women occurs in epidemic proportions, and is largely accepted all across the world. Capitalist societies are not willing to commit the resources needed to stop the violence, and objectification of women's bodies for commercial gain and precarious family economic conditions actively encourage it. The threat of violence is always present and controls women's activities and lives even if they are not directly experiencing verbal abuse and physical violence.

The most vulnerable women, in poor and indigenous communities, suffer the most, but women from more prosperous backgrounds are not immune. In the United States, some 25 percent of college-educated women report surviving rape or attempted rape during college.[62] The World Health Organization estimates that about one-third of all women have experienced either physical or sexual violence, commonly at the hands of their intimate partner.[63] Gender violence is more of a threat to women's health than the sum of all traffic accidents and malaria.[64]

Imperialism and War

We have previously discussed the detrimental effects of being a worker, a woman, and "racial" minority in capitalist societies. Entirely different dimensions occur with the damage done to conquered native peoples and to those in countries on the receiving end of military and covert interventions by the most powerful leaders of the capitalist world order. Imperialism with or without colonies is integral and essential to capitalism; the accumulation of capital propels the constant need for new markets, resources, cheap labor, and geopolitical advantage. Whole continents have been stolen and millions of people killed, directly through military means or indirectly by disease, starvation, and slavery. Large regions of the world have been pillaged of their natural resources and repeated attempts have been made to eradicate alternative cultures, all to fuel the engine of capitalism. Wars and occupations carried out by wealthy countries are not confined to the early period of capitalism, but are just as much a feature of the present. Earlier we discussed how essential colonialism was to the growth and development of capitalism, providing much of the wealth that began and propelled its rapid growth, and the brutality of the colonial powers as they occupied land

and subdued the original inhabitants (see *The Rise and Growth of Capitalism* in chapter 2).

Theft of Land and Culture

Capitalism operates so as to destroy ways of life that are at odds with its priorities of having a docile population and pursuing profits. In settler colonial states such as Canada, the United States, Australia and New Zealand the occupiers stole almost all the land and forcibly disrupted the economies and banned native cultures' ways of interacting with the land, leaving natives uprooted and disenfranchised. To this day, many of these people continue to fight for the retention of their culture, the return of their land, and equal rights.

Of countless possible examples in settler colonies, the offenses to the Standing Rock Sioux tribe, and its impacts on a people, a culture, the land, is a standout for its recurrence.

Beginning in April 2016, thousands of Native Americans from hundreds of tribes formed an occupation site on the banks of the Cannonball River to try to stop or reroute the Dakota Access Pipeline (DAPL), a $3.7-billion-dollar project that would transport crude oil from the Bakken oil field in North Dakota to a refinery to Patoka, Illinois, near Chicago. The 1,720-mile pipeline, roughly thirty inches in diameter, would carry 470,000 barrels per day and is a project of Energy Transfer Partners.

The young people of the local Standing Rock Sioux tribe were joined by thousands of supporters, including a group of military veterans, to protest an undemocratic decision, one that skirts the law by claiming that the huge pipeline project is really just a number of small projects. Doing so eliminates the need to follow the regulations of the Clean Water Act and the National Environmental Policy Act.

In the 1960s, the U.S. government stole hundreds of thousands of acres from the Standing Rock Sioux Reservation in order to build dams in the Missouri River watershed. In the process, "hundreds of Indian families from various tribes were forcibly relocated and their way of life completely destroyed. The staggering poverty that resulted from the program lives on across the Dakotas today."[65] According to Kelly Morgan, an archaeologist

and member of the Standing Rock Sioux, the land theft "completely stole our burials, our resources, our woods and a lot of the traditional plants…. A complete lifeway degradation and families completely uprooted."[66]

David Archambault II, chairman of the Standing Rock Sioux tribe, explained:

> It's a familiar story in Indian Country. This is the third time that the Sioux Nation's lands and resources have been taken without regard for tribal interests. The Sioux peoples signed treaties in 1851 and 1868. The government broke them before the ink was dry….
>
> Whether it's gold from the Black Hills or hydropower from the Missouri or oil pipelines that threaten our ancestral inheritance, the tribes have always paid the price for America's prosperity.[67]

What makes the situation even more egregious is that a portion of the disputed pipeline route is slated to go through land that was never ceded. It was stolen by Congress despite treaties signed by the Sioux in 1851 and 1868, during the years of the Gold Rush, which granted them "absolute and undisturbed use and occupation" of a vast area outside the formal reservation.[68] The fact that the pipeline had already been rerouted away from white communities illustrates the racist nature of the decision-making process.

Under great public pressure, the Army Corps of Engineers announced in December that they would not grant an easement for the pipeline in southern North Dakota. However, with the company refusing to consider rerouting the pipeline and the Trump administration approving its final phase, ongoing resistance is needed against building other oil and gas pipelines.

Land theft from indigenous peoples persists in many countries, as private capital and sovereign wealth funds carry out twenty-first-century land grabs.[69] Those fighting land theft and environmental degradation around the world are in the cross-hairs of capital—an estimated 185 environmental activists across the Global South were assassinated in 2015.[70] The 2016 murder of Berta Cáceres, a leader of the Lenca people of Honduras in the struggle against the flooding of land to build a dam, followed by the assassination of two other members of the group, is an

indication of the bravery and fortitude needed by those trying to protect the land of indigenous peoples.

Creating Antagonisms in Colonies

The legacy of colonial rulers' universal practice of inventing or exacerbating differences in ethnicities and cultures to divide and rule continues to torment the world. Deliberately fostering tensions between different groups, such as the Tutsi and Hutu in Rwanda (a former colony of Germany, then of Belgium), is a common technique of colonial powers, making it easier to rule. Hindu-Muslim antagonisms in India and the Pakistan-Indian hostilities after the creation of Pakistan, with literally millions killed and the largest forced migration in history occurring during the partition of India, were products of societal changes brought about during British colonial rule and forced retreat from the Indian subcontinent in 1947. The Muslim Shia-Sunni antagonism was given social force by colonial rule and the drawing of arbitrary borders following the First World War.

Death and Destruction by Imperial Interventions

Numerous imperialist interventions have been carried out by the United States and its European junior partners, covertly as well as by direct military force. They continue to have dreadful social consequences, causing enormous numbers of deaths, population dislocations, and environmental havoc. More than fifty countries were bombed, invaded, or destabilized by overt and covert U.S. interventions after the Second World War. The list includes overthrowing governments in Iran and Guatemala, fomenting and aiding counter-insurgency campaigns in El Salvador and Nicaragua, and outright military interventions in Vietnam, Grenada, Afghanistan, Iraq, Libya, and Syria. The discussion below is far from an exhaustive treatment of meddling, invasions, and bombings, covering only some of the consequences of selected interventions occurring since the Second World War. But the examples provide some idea of the death and disruption they have caused over the last 50 years.

In the mid-1960s, the United States assisted in the slaughter of hundreds of thousands, perhaps as many as a million, suspected Indonesian communists:

> The United States provided the special radio system so the Army could coordinate the killings over the vast archipelago. Bob Martens, who worked at the United States Embassy in Jakarta, compiled lists of thousands of names of Indonesian public figures who might be opposed to the new regime and handed these lists over to the Indonesian government.[71]

The United States played an important role in the 1973 coup against Salvador Allende, the president of Chile, for the offense of being a democratically elected socialist. To this day, the people of Chile are still fighting for justice from the repression and killings of thousands of Chileans and hundreds of thousands forced into exile, orchestrated by the military dictatorship of General Augusto Pinochet and supported by the U.S. government. According to Peter Kornbluh of the nonprofit National Security Archive, Henry Kissinger was "the singular most important figure in engineering a policy to overthrow Allende and then, even more, to embrace Pinochet and the human-rights violations that followed."[72]

After the Second World War, France fought viciously to try to maintain its colony in Vietnam, passing the imperial baton to the United States to stop Vietnam from becoming a united independent country. After decades of war, Vietnam won, but it suffered deaths estimated in the millions and the country was left in ruins by the bombings, assassinations, and ecocide from widespread use of the herbicide Agent Orange. The Vietnamese people continue to suffer casualties from unexploded ordnance (the United States dropped more high explosives on Vietnam than all countries combined during the Second World War) and suffer ongoing contamination from the aftereffects of chemical warfare seeping into land, water, and genes.

As part of the war in Indochina, for years the United States secretly (because it was illegal under U.S. law) bombed neighboring Cambodia and Laos, supposedly to stop its use by Vietnamese fighters. The ensuing social dislocation caused by the carpet bombing of Cambodia created the

opportunity for the barbarism of Pol Pot's Khmer Rouge. William Shawcross has written that the "Khmer Rouge were born out of the inferno that American policy did much to create…. It was American policy that engulfed the nation in war…. Cambodia was not a mistake; it was a crime."[73]

Although the United States was the primary support for Iraq and Saddam Hussein during the Iraq-Iran War in the 1980s, it turned against the regime in the 1990s. After the international sanctions orchestrated by the Clinton presidency (estimated to have caused over 1 million deaths, half of whom were children), there were the later killings and torture following the 2003 U.S. invasion of Iraq (over half a million people died), and the destruction of vital infrastructure. These facts, plus the U.S. sponsorship of an Iraqi government composed of Shia Muslims, which quickly began to oppress the Sunni minority, created all the necessary conditions for the rise of a militant resistance against U.S. intervention.

In 2015 and 2016, Saudi Arabia carried out a brutal war against Yemen, one of the poorest countries in the world. "This rain of destruction was made possible by the material and moral support of the United States, which supplied most of the bombers, bombs, and missiles required for the aerial onslaught. (Admittedly, the United Kingdom, France, and other NATO arms exporters eagerly did their bit.) U.S. Navy ships aided the blockade."[74]

By support for every outrage of the colonial settler state of Israel, the United States continues to destabilize the Middle East and foster more violence. But a part of the stage was set when the United States and Saudi Arabia colluded to foster "political Islam" as an alternative to the rise of nationalist and socialist-oriented regimes in the 1950s and 1960s, especially in Egypt and Syria. According to a U.S. State Department memo of a 1957 meeting to discuss countering Soviet influence in the Middle East: "The President [Eisenhower] said he thought we should do everything possible to stress the 'holy war' aspect."[75] As Samir Amin has written, "Political Islam would have had much more difficulty in moving out from the borders of Saudi Arabia and Pakistan without the continual, powerful, and resolute support of the United States."[76]

The focus above on the cruel history of U.S. overseas military and economic interventions is merely a reflection of its global economic and

military dominance since the Second World War. Martin Luther King's words ring as true today as in 1967 when he referred to the United States as "the greatest purveyor of violence in the world today."[77] As we noted earlier, imperialism and war are as integral to capitalism as class exploitation and racism. Also pointed out earlier, colonial powers such as Britain, France, Belgium, and Germany were just as brutal as the United States, and many of these countries cooperate today in U.S.-led interventions or attempt their own imperial interventions. Following the debacles in Afghanistan and Iraq, United States dominance is beginning to be challenged by small countries that no longer automatically back U.S. policies as well as by China and Russia, each jockeying for geopolitical advantage.

Imagine Change

Capitalism is an economic system in which businesses strive to do everything possible to maximize profits in the shortest period of time—*even if it means destroying a habitable planet*. A system that does not meet the basic needs of the mass of humanity, a system that continues to harm so many people, a system in which countries use force to promote their perceived geopolitical and economic interests, unable to stop itself from destroying the biosphere it depends on, is a system that desperately needs to be superseded by a different system: one that has completely different goals, logic, and ways of operating, a society based on substantive human equality and that regenerates and then maintains a healthy ecosystem. But given our relationship to nature, our own behavioral characteristics, and the supposed innate differences among different groups of people, is such a society even possible? This is to this question that we turn in Part Two.

PART TWO

Is an Ecological Society Possible?

5

Humans as Part of Nature

> Let us not … flatter ourselves overmuch on account of our human victories over nature. For each such victory nature takes its revenge on us. Each victory, it is true, in the first place brings about the results we expected, but in the second and third places it has quite different, unforeseen effects which only too often cancel out the first…. At every step we are reminded that we by no means rule over nature like a conqueror over a foreign people, like someone standing outside nature—but that we, with flesh, blood and brain, belong to nature, and exist in its midst, and that all our mastery of it consists in the fact that we have the advantage over all other creatures of being able to learn its laws and apply them correctly.
>
> —FREDERICK ENGELS[1]

IN CHAPTERS 3 AND 4, we discussed how systemic environmental and social problems are caused by and are intrinsic to capitalism. Tinkering with the system, passing stand-alone laws or enforcing the odd regulation will not solve the root causes of the crises we face. We must ask ourselves: is there something about humans that poses an insurmountable barrier to a new socioeconomic system? Chapters 5, 6, and 7 examine what history and science tell us about how humans have interacted with and changed their environments, and will help us determine whether innate human traits and characteristics prevent us from creating a society based on equality and justice.

Nature is a hard word to define. Originating in Latin as *natura*, meaning "birth," today people give the word a wide variety of meanings.

Colloquially, it's used as a blanket term applied to everything that isn't human or constructed by humans. In everyday speech, people refer to animals as if humans were in an altogether different category (aside from species), instead of being fellow animals. The *Oxford English Dictionary* definition of nature makes a differentiation between nature and humans rigidly explicit: "the phenomena of the physical world collectively, including plants, animals, the landscape, and other features and products of the Earth, as opposed to humans or human creations."[2] This setting apart of humans as something so different from other species and nature so as to require our own category creates an artificial and damaging dichotomy.

Nature in Western societies is commonly viewed as a place that we travel to visit rather than inhabit on a daily basis. Under capitalism, the dominant ideology postulates that though some of us might feel remorse for the negative consequences our actions have on other species, we are nevertheless compelled by our innate nature to behave as conquerors, to consider ourselves as outside of nature, a species free to exploit other life-forms and the rest of the world without awareness of a deep and vital connection to the rest of the biosphere. It is not merely scientifically incorrect; it disastrously distorts our self-understanding and in the long run is self-defeating.

A rigidly anthropocentric view stemming from biblical conceptions of the domination of nature and placement of earth at the service of humans holds that humans are not only the center and most important part of life on Earth but sit at the apex of biological development. It is therefore our right to dominate and exploit the rest of nature. This view is a complete misunderstanding of the science of evolution and ecology. However distantly, all living organisms are connected to one another through evolution. We are one of an estimated 8.7 million species living on Earth. Even among mammals, *Homo sapiens* is only one of more than 5,000 species.

From an evolutionary perspective, *Homo sapiens*, is one of the four genera in the Hominidae family, which includes chimpanzees, orangutans, and gorillas. We are most closely related to bonobos and chimpanzees, sharing close to 99 percent of our DNA with them. In direct contrast to the popular graphics depicting a single evolutionary line in the form of a ladder,

from bipedal hominid to human, archaeological evidence shows a far richer set of multiple pathways by which our species evolved.

Our genus (*Homo*) had many branches, including us (*Homo sapiens*) and a number of species now extinct, such as *Homo neanderthalensis*, *Homo erectus*, *Homo habilis*, *Homo floresiensis*, and the latest member, *Homo naledi*, whose remains were found in a cave in South Africa in 2013 and first described in 2015. Both *Homo neanderthalensis* and *Homo naledi* may have buried their dead, a practice once considered unique to our species. Our lineage branched off from the others in the great ape family about 3 million years ago.

Homo sapiens originated approximately 200,000 years ago in East Africa. Genetic evidence indicates that the population went through a bottleneck approximately 70,000 years ago with greatly reduced numbers, possibly connected to unfavorable climate change. The period coincides with the Mount Toba volcanic eruption in Sumatra—the largest in the last few million years—which sent enough ash into the atmosphere to cause major and prolonged climate change in many parts of the world.[3] Although there were earlier dispersals of humans who died out, those that populated Eurasia, Australia, Oceana, and the Americas appear to be descended from a group that left Africa around 50,000 to 70,000 years ago.[4] Complicating the popular stories of *Homo sapiens* relentlessly wiping out our cousins the Neanderthals in acts of genocide, recent research indicates not only that we interbred and mingled our DNA, but that Neanderthals, again contrary to popular mythologizing, were not nearly as limited in cognition as once proposed.

As the human population increased and acclimated to new environments demanding new skills, our ancestors began to make different tools, such as improved points and blades for cutting and spearing, objects for adornment, and cave paintings. Over the past 10,000 years, our species has transitioned from small groups hunting and gathering to more stable settlements practicing agriculture and the domestication of plants and animals to greater concentrations in towns and cities with greater divisions of labor.

Nature and Cities

Today, for the first time in human history, more people live in cities than in rural areas. Living in giant urban settings, humans are increasingly separated from an intimate and daily relationship with soil, wild animals, crops, and other plant life. We are often unaware of the nature that exists in cities and have lost sensitivity to the smaller-scale changes in weather patterns. Amid the cacophony, frenetic pace, and steel-and-concrete construction of these degraded urban landscapes, it is not at all surprising that many people feel that nature exists somewhere other than where they live.

But whether we are aware of it or not, even as we inhabit large cities, still a part of nature and intimately connected with the biosphere, especially with the plants and animals on which we depend for food and medicines, as well as the species that help maintain them: the grasses that feed cattle and goats, the bees that pollinate many crops, and the wasps that attack insects that eat or otherwise harm food plants. The aesthetic pleasure and spiritual and psychological sustenance that humans derive from seeing plant life in forests, gardens, fields, and city parks is considerable.

Numerous studies have shown that connecting with aspects of nature in urban green spaces enhances physical and psychological health and resiliency.[5] The simple appreciation and enjoyment of nature's beauty is a key part of human well-being and can be found in diverse events and environments: the intricacies of a butterfly's wing; the color, scent, and form of a flower; the sound of birdsong floating on the summer breeze; the miraculous and seemingly organized swarms of birds and fish; the amazing multitude of beetles; the green of a prairie after rain; the new leaves of spring; the feel of hard bark beneath one's palm; the long-distance migrations of sea creatures and those with wings.[6] Our world is filled with inexhaustible beauty and wonder, an evolutionary masterpiece, begetting and changing life in constant involvement and interaction with its surroundings.

When a beaver uses tree branches and tree trunks to build a dam for water control and a den for protection, everyone would agree that this is part of nature. We would think the same for bird's nests, beehives, and so on. The Australian male brush turkey covers its eggs with just enough of the right amount and type of material to let the decomposing substances warm the nest; the eggs hatch without being constantly warmed by a parent

turkey sitting on them. So why is a house built out of wood by humans not equally a part of nature? And why is a brick made from clay by human hands somehow not natural?

Although humans have brought gigantic and long-term changes to Earth, there still exists an innate human affiliation and bond with nature—a biophilia. One indication of this is that there are strong positive effects from humans seeing and interacting with other living organisms. It should not be much of a surprise that we have an affinity for the forms of life with which we co-evolved. For example, in England researchers at the University of Exeter Medical School analyzed mental health data from over 10,000 city dwellers over a period of eighteen years, using high-resolution mapping to track where the subjects lived. They found that people living near more green space reported less mental distress, even after adjusting for income, education, and employment, which are also correlated with health and well-being. In 2009, a team of Dutch researchers found a lower incidence of fifteen diseases—including depression, anxiety, heart disease, diabetes, asthma, and migraines—in people who lived within a half mile of green space. In 2015, an international team overlaid health questionnaire responses from more than 31,000 Toronto residents onto a map of the city, block by block. Those living on blocks with more trees showed a boost in heart and metabolic health equivalent to what one would experience from a $20,000 gain in income. Lower mortality and fewer stress hormones circulating in the blood have also been connected to living close to green space.[7]

The quintessentially human-created environment of the city, with acres of asphalt, canyons of steel, brick, and concrete, thousands of car engines, the screaming sirens and honking horns, and millions of humans, is also natural, constructed by a natural species. Cities are also places where wildlife exists, and are ecosystems in their own right.

After fourteen years of tracking the more than 2,000 coyotes that are thriving on the streets of Chicago, ecologist Stanley Gehrt has reversed earlier assumptions about the expected dearth of wildlife: “When we started, we didn’t think there was going to be much of a study there…. We were wrong.”[8] In New York City, one can find deer, owls, coyotes, turtles, opossum, egrets, herons, falcons, bats, a number of aquatic animal species, and many different insects and plants. Mountain lions have migrated to Los

Angeles. In Moscow, there is a population of feral dogs who know how to use the subway.

The more we find out about urban ecology, and take seriously the premise that urban landscapes can be an opportunity for wildlife as much as a challenge, the more that surprises turn up. A new scientific technique, relying on the variation in abundance of different forms (isotopes) of individual elements, allows a distinction to be made between whether the diets of urban animals have switched from their normal prey to human food waste. Though it varies from location to location, the coyotes of Chicago still primarily eat what they always have: rodents, other small mammals, and wild fruit.

Animals play an important role in cleaning up after humans. Researchers found that on the grassy median areas between major streets in New York City, significant food-waste consumption was being undertaken by insects in a manner unnoticed but beneficial to humans:

> When vertebrates also had access to food, more was removed, indicating that arthropods and vertebrates compete for littered food. We estimate that arthropods alone could remove 4–6.5 kg [about 9 to 14 pounds] of food per year in a single street median, reducing its availability to less desirable fauna such as rats…. Even small green spaces such as street medians provide ecosystem services that may complement those of larger habitat patches across the urban landscape.[9]

There are all sorts of organisms living with us in cities. Vegetation in parks and trees along streets are there by design. On the other hand, without conscious human encouragement, numerous types of animals are attracted to cities and find urban niches in which to live. Some of the influx is a result of the decline of original wildlife habitat, as humans spread out into suburbs and other satellite communities.

Urban ecology is an outcome of how humans live and forms an important potential component toward overcoming rifts and disturbances that arise in the interactions of humans with the rest of the natural world. In a future ecological society, a key objective for urban planners will be to enhance and expand the spaces where humans, other animals, and plants

coexist, even in highly urbanized areas where humans predominate. More significantly, a major objective will be to reconnect urban and rural life to eradicate a major component of the ecological rift. Over time, this will require reconfiguring the location, size, and design of cities.

Humans, Plants, and Microorganisms

Human existence is intertwined with innumerable other organisms—their presence, activity, and balance impact our health. Although some microorganisms cause human diseases, most are either benign or play a role in keeping us healthy. These include not only those microorganisms that enable our digestive system to function and perform many other roles inside our bodies to keep us healthy but also the billions of organisms that live on our skin. Indeed, the human microbiome contributes about as many cells to our bodies as we have human ones. Perhaps we are better described not as a single organism but as a sentient collection of organisms functioning together for mutual benefit.

We discussed earlier the aesthetic and psychological benefits humans receive from just being near and seeing plants in cities and in rural areas. However, the human-plant interaction is at the very basis of our physical existence. Our entire sustenance is derived either directly from plants or indirectly by consuming organisms that themselves consume plants. The energy and nutrients for our bodies are all derived from plants. And many important medicines are derived from plants, such as quinine, codeine, taxol, and aspirin. Medical researchers originally examined many of these plant-based chemicals because of their use in traditional medicine by people around the world. Plants we use for food also have their own microbiomes, helping plants survive in difficult circumstances and defending themselves from insects in diseases (see pages 226–228).

The oceans provide another example of the complexity of interactions between plants, humans (and other animals), and microorganisms. Seagrass beds surround all the continents except Antarctica. They “play an outsize role in the health of the oceans. They shelter important fish species, filter pollutants from seawater, and lock up huge amounts of atmosphere-warming carbon.”[10] These ocean meadows provide habitat for fish that

humans consume as well as numerous other animals including species of anemones, lobsters, sea turtles, and mollusks. In addition to being unusually rich in biological diversity, water in seagrass beds contains fewer bacteria that cause diseases in humans and marine organisms and coral adjacent to seagrass is healthier than at some distance.[11]

Humans and Other Animals

We are clearly different from other animals, but then cows are different from horses and worms are different from insects. We are different from other animals not just because we use tools, for some other animals do that as well. Ravens, chimpanzees, elephants, and other animals have been observed to use simple tools such as sticks or rocks to access food and water and for other purposes. Even uniquely human abilities, such as conscious decision making and appreciation of past and future are no longer thought to be as unique as once postulated. Reflecting on recent research findings, Charles Siebert, writing in the *New York Times*, notes:

> Advanced neurological and genetic research … has shown that animals like chimpanzees, orcas and elephants possess self-awareness, self-determination and a sense of both the past and future. They have their own distinct languages, complex social interactions and tool use. They grieve and empathize and pass knowledge from one generation to the next. The very same attributes, in other words, that we once believed distinguished us from other animals.[12]

The discovery of the fossil remains of *Homo naledi*, the most recently found extinct member of the genus that includes our species, "is a major paleontological breakthrough," commented primatologist Frans de Waal. "Why not seize this moment to overcome our anthropocentrism and recognize the fuzziness of the distinctions within our extended family? We are one rich collection of mosaics, not only genetically and anatomically, but also mentally."[13]

Humans also share certain behaviors with some other animals—behaviors once thought to be uniquely human, such as grieving over the

death of a family member or friend or being upset when treated unfairly. After watching a dolphin mother stay close to her dead calf for two days in the waters of Greece's Amvrakikos Gulf, biological anthropologist Barbara King notes the newness of the idea that animals other than humans express such emotions:

> Was the dolphin mother truly grieving for her dead calf? A decade ago I would have said no. As a biological anthropologist who studies animal cognition and emotion, I would have recognized the poignancy of the mother's behavior but resisted interpreting it as mourning. Like most animal behaviorists, I was trained to describe such reactions in neutral terms such as "altered behavior in response to another's death." … Tradition dictates that it is softhearted and unscientific to project human emotions such as grief onto other animals.[14]

Having seen similar responses in other species, King concludes that there can be an evolutionary advantage, or trade-off, to the development of behavior that at first glance appears to make an animal more vulnerable to predators. Emotional distress can be an adaptation that promotes better cooperation and support from others, thereby enhancing survival. "What is adaptive, then, may not be grief itself but instead the strong positive emotions experienced before grief comes into the picture, shared between two or more living animals whose level of cooperation in nurturing or resource-acquisition tasks is enhanced by these feelings."[15]

While other animals seem capable of expressing grief, we are the only living species that anticipates death (as far as we currently know) and weaves the symbolism of it deeply into our art, poetry, writing, and music, with evidence of ceremonial activities around gravesites being one of the earliest examples of human culture. Humans plan future actions with one another—sometimes far into the future. We cooperate in complex ways that other animals cannot, we record and are aware of the distant past and imagine a future, which allows for the perpetuation and evolution of complex culture.

Although humans share important characteristics with other animals, we are nevertheless unique in significant ways, particularly in the development

and use of complex language. This has made it possible to learn and transmit to future generations the knowledge to produce and use increasingly sophisticated tools and machines, allowing humans to shape their local, regional, and global environments in more conscious ways than other animals. Humans are part of the large family of life, and certainly not creatures standing aside from, or above, other species.

Ideology, Ecology, and Humans

There is no such thing as "pristine wilderness" undisturbed by humans anywhere in the world. For example, so-called virgin forests, even including rain forests that have provided habitat for humans for thousands of years, have been altered. Airborne pollutants such as mercury from coal-fired power plants have changed forest soils even in remote locations. If we humans are a part of nature, then to even talk of a "pristine" environment at all is misrepresentative and ideological.

What we can describe are local ecologies that have been *more altered* versus those that have been *less altered*; that is, those appropriated for direct human use versus those that have reverted or evolved toward a new or different state following such disturbance or remote enough to have been subjected to only small effects of human activity. The forest that we might enjoy walking through in the eastern United States is likely second- or third-growth, and very different from the colonial or pre-colonial forest. Years after clear-cut logging, a second-growth forest may contain a large number of species of plants and animals, but usually they are less biologically diverse than the original forest because recovery to something resembling a pre-altered state of biodiversity requires a very long time and in many situations may not even be possible.

The notion that newly "discovered" land was "untouched by man" furnished the colonialists and imperialists of history and today's proponents of capitalist development with a rationale for the essential rightness of their conquests. If the lands of the New World, Asia, Oceania, and Africa were virgin, primeval, underutilized, or not much "improved" by the humans already living there, then why not put the land to good use through

occupation, conquest, and suppression of the native population, along with the exploitation of the "natural" world for profit?

Environmental historian Carolyn Merchant points out that the "recovery" of Eden, the biblical garden planted by God but lost in the Fall, is "a powerful narrative, functioning as ideology and legitimation for settlement of the New World, while capitalism, science, and technology provided the means of transforming the material world."[16]

But contrary to the myth that the original colonial invaders of the Americas found only small wandering bands of Neolithic hunter-gatherers and mysteriously collapsed empires, the Western Hemisphere was densely populated. An estimated 100 million people lived in the Americas at the time of the European invasion, existing in a range of sophisticated and highly developed societies, with their own transportation networks and trade routes that connected the two continents, their own legal systems and political decision-making processes. Historian Roxanne Dunbar-Ortiz, author of *An Indigenous Peoples' History of the United States*, notes the intimate connection between the cultivation of corn and the growth of complex social systems integrated across space and time:

> Unlike most grains, corn cannot grow wild and cannot exist without attentive human care…. Corn, being a summer crop, can tolerate no more than twenty to thirty days without water and even less time in high temperatures. Many of the areas where corn was the staple were arid or semiarid, so its cultivation required the design and construction of complex irrigation systems—in place at least two thousand years before Europeans knew the Americas existed. The proliferation of agriculture … could not have occurred without centuries of cultural and commercial interchange among the peoples of North, Central, and South America, whose traders carried seeds as well as other goods and cultural practices.[17]

The development of agricultural systems and ways of hunting and living resulted in many changes to the landscape in the Americas well before the arrival of any colonists. Its many millions of inhabitants significantly and consciously altered the land. In *Changes in the Land*, a work of environmental history studying pre- and postcolonial New England,

William Cronon writes: “Indians had lived on the continent for thousands of years and had to a significant extent modified it to their purposes…. The choice is not between two landscapes, one with and one without human influence; it is between two human ways of living, two ways of belonging to an ecosystem.”[18] Cronon goes on to argue that American Indians purposefully transformed forests and radically altered the ecology of New England. But when the Puritans arrived, changes became more extreme and “could sometimes go so far as to remove the forest altogether, with deleterious effects for trees and Indians.”[19] Humans and the physical, cultural, and economic environment within which they exist are in continual exchanges and feedback with each other, producing new possibilities and contradictions:

> An ecological history begins by assuming a dynamic and changing relationship between environment and culture, one as apt to produce contradictions as continuities. Moreover, it assumes that the interactions are dialectical. Environment may initially shape the range of choices available to a people at a given moment, but then culture reshapes the environment in responding to those choices. The reshaped environment presents a new set of possibilities for cultural reproduction, thus setting up a new cycle of mutual determination between people and the environment.[20]

This mutual shaping is important to note. There are many instances of dramatic changes to the environment and societies, and the causes are complex. It is commonly argued that humans have had only a negative impact on the natural world, even to the point of causing societies to collapse, at least partially because of harm they did to the environment.[21] If numerous previous human societies caused such damage as to lead to their collapse, the blame for the incredible ecological damage currently occurring must be a replay of such human shortcomings.

However, a growing body of research takes exception to that approach. It explores historical-cultural-ecological interactions and what happened to societies that appear to have changed drastically, even “collapsed.” In their co-edited book *Questioning Collapse: Human Resilience, Ecological*

Vulnerability, and the Aftermath of Empire, anthropologists Patricia McAnany and Norman Yoffee summarize much of this work as follows:

> When closely examined, the overriding human story is one of survival and regeneration. Certainly crises existed, political forms changed, and landscapes were altered, but rarely did societies collapse in an absolute and apocalyptic sense. Even the examples of societal collapse often touted in the media—Rapa Nui (Easter Island), Norse Greenland, Puebloan U.S. Southwest, and the Maya Lowlands—are also cases of societal resilience when examined carefully.[22]

Although mistakes were made, people generally learned how to adjust practices to better match their soils, topography, and climate. They developed worldviews that acknowledged the importance and interconnectedness of the natural world and themselves as part of it. Now, faced with pressure from climate change as well as those wanting to exploit resources in their lands, some indigenous peoples have responded by expressing a long held belief in the unity of nature and resistance to further degradation. A Yanomami leader and shaman from Brazil, Davi Kopenawa, offers such a perspective:

> When they speak about the forest, white people often use the word "environment." What they refer to in this way is what remains of everything they have destroyed so far. I don't like this word. The Earth cannot be split apart as if the forest were just a leftover part. With leftover trees and leftover rivers, leftover game, fish and humans who live there, its breath of life will become too short. That is why we are worried. We shamans simply say we are protecting nature as a whole thing. We defend the forests' trees, mountains and rivers, its fish, game, spirits and human inhabitants. We even defend the land of the white people beyond it and all who live there.[23]

There is clearly a lot to learn from this approach to nature. Yet this does not mean that indigenous people are somehow closer to nature. The cultural attitudes of indigenous foragers or agricultural village societies toward the

natural world stem from the way in which those societies depend directly on their knowledge of nature in order to stay alive. Historically, their resource use was relatively limited, with low productivity, and people could always move somewhere else if life became too difficult. Long-lasting indigenous cultures evolved over time—through trial and error, by paying attention to lessons learned, and transmitting successful strategies to future generations.

What happened to the giant empires and city-states that left their mark in magnificent architecture, often built by the slave labor of conquered peoples, and the intricate and incredible artifacts, pottery, and jewelry of these many varied cultures? Societies such as the Maya were frequently held together by fragile alliances and subjugation of conquered peoples. When such a society collapses, the upper layers of the hierarchies disappear. After the collapse of the power structure that held together the classical Mayan civilization, people moved to new locations and the cities were abandoned. But the Maya people, their language, and most of their culture continued. What disappeared were the upper classes and their formal alliances across geographic areas.

The consensus among scientists studying changes in ancient societies is that human culture and society have proved remarkably resilient. When problems occurred, such as soil erosion in the Mediterranean, people changed practices and adapted to the new situation in ways that perpetuated their societies (see page 51). Those types of creative responses in antiquity as well as current local indigenous knowledge and ways of thinking about our relationship to nature need to be combined with scientific knowledge that is developed without the perspective of profit making and its consequent deleterious effects on our physical environment and various cultures. This will provide the opportunity for human societies to thoughtfully plan and coordinate our interactions with the world around us, and with one another, in order to be ecological and sustainable stewards of the future on a global scale.

The more we learn about the history of different cultures, the more we undermine the idea that humans are innately destructive as a species. The more we learn about the biology and behavior of other species, the more we overturn the idea that we are separate and completely distinct from them. Our intellectual abilities, combined with our potential for cooperative and

conscious planned actions over long time scales, give us a unique opportunity among species: to think through our interactions with the environment in which we live, to experiment to find the most ecologically sound processes and procedures, and to regulate our interactions with the biosphere as we go about providing ourselves with life’s needs. Our human characteristics in no way preclude our ability to do so.

6

Does Human Nature Prevent System Change?

> Poor human nature, what horrible crimes have been committed in thy name! Every fool, from king to policeman, from the flatheaded parson to the visionless dabbler in science, presumes to speak authoritatively of human nature. The greater the mental charlatan, the more definite his insistence on the wickedness and weaknesses of human nature. Yet, how can any one speak of it today, with every soul in a prison, with every heart fettered, wounded, and maimed?
>
> —EMMA GOLDMAN[1]

THOSE WHO WANT TO CREATE an ecologically healthy society based on equality and social justice are confronted by a commonly held assumption that humans are hardwired for capitalism. It is an argument used by ruling elites throughout history—what better way to promote an economic or political system than by claiming it's the natural outgrowth of human behavior?

Apologists for the system argue, as did Britain's former prime minister Margaret Thatcher, "there is no alternative" to capitalism. Former U.S. State Department official Francis Fukuyama, after the collapse of the Soviet Union, went so far as to claim that capitalism represents "the end of history." [2] More recently, in 2017 on CNN, in response to a student question about the fact that a majority of younger Americans now disdain capitalism and want something radically different, veteran Democratic Party leader Congresswoman Nancy Pelosi nevertheless responded that there was no alternative, "[W]e are capitalist. That's just the way it is."[3] By their

analysis, an equitable, just, and ecological society is not possible because human progress has reached its apex with the development and spread of capitalism. Capitalism is here to stay because humans are, by our very nature, individualistic, greedy, acquisitive, and competitive. The long march of human progress has, by this narrative, reached its apex with the overthrow of previous economic and political systems and the development and spread of capitalism.

Nevertheless, what is commonly referred to as "human nature" has changed a great deal throughout the history of humanity. When social systems change, so do culture and behavior, as people adapt to new social structures and customs. The wide range of human characteristics, traits, and behaviors runs the gamut from the killing or torture of others, greed, selfishness, individualism, and competitiveness to cooperation, reciprocity, empathy, altruism, and the desire to be treated, and treat others, with fairness. Though all these potentials are within us, different societies have encouraged and rewarded some while suppressing others.

Critics of change to the existing capitalist order argue that even if a successful revolution takes place—one based on solidarity, reciprocity, cooperation, equality, and genuine democracy—entrenched leaders and inequalities will inevitably reemerge. Driven by ambition and a lust for personal glory, wealth, or status, they will ultimately subvert the high ideals they had once promised to uphold.

Look at the Soviet Union, critics say. Tyrannies arise even out of well-meaning attempts to create just and humane societies because people are naturally selfish and will dominate others if given the chance. These critics assume the same behavioral traits are dominant in all human cultures as those that are prominent under capitalism—a form of social organization based on aggressive competition to maximize profit—but the actual history of our species illustrates a different, more hopeful reality. Education reformer John Dewey saw this more hopeful possibility when he wrote in *The Encyclopaedia of the Social Sciences* in 1932:

> The present controversies between those who assert the essential fixity of human nature and those who believe in a great measure of modifiability center chiefly around the future of war and the future of a competitive economic system motivated by private profit. It is

> justifiable to say without dogmatism that both anthropology and history give support to those who wish to change these institutions. It is demonstrable that many of the obstacles to change which have been attributed to human nature are in fact due to the inertia of institutions and to the voluntary desire of powerful classes to maintain the existing status.[4]

Lets take a look at how people behaved in different societies and which traits or characteristics predominated. We'll start with hunter-gatherer societies, in which our species spent more than 90 percent of our existence, and then look at small agricultural and mixed agricultural/hunting and gathering societies, and finally societies that developed fixed classes, using capitalism as the main example.

Hunters and Gatherers

Certain traits, some found in closely related species, are thought to have been critical for the evolution of humans and their subsequent development. For example, the desire for just outcomes in humans and a number of nonhuman species is indicated by a profound sense of wanting to be treated equally. Protesting unequal treatment and trying to equalize outcomes are examples of this phenomenon. Researchers summarizing numerous studies on a variety of animals conclude: "Humans and other species seem to share basic [negative] reactions to inequity, which serve the need for sustained cooperation."[5]

Cooperation among members of our particular species, *Homo sapiens*, was critical for early survival when it emerged about 200,000 years ago. It also greatly contributed to the development of ancient cultures and societies:

> It was cooperation … whether in the form of monogamous pairs, nuclear families or tribes, that enabled humans to succeed when all our fossil ancestors and cousins went extinct. In fact, cooperation may be the greatest skill we have acquired during the past two million years [of evolutionary change]—one that enabled our young genus to survive through periods of environmental change and stress

> and one that may well determine our geologically young species' future.[6]

Over millennia, members of our species, the only remaining member of the *Homo* genus, demonstrated a high degree of cooperation and adaptability as they spread throughout most of the world. Science journalist Stefan Klein describes the evolutionary and social benefits of cooperative traits and helping others in early human societies and how it relates to today:

> Everything argues that our ancestors could only afford [the energy expenditure needed to maintain] their large brains once they had learned how to minimize the risks of existence by working together. Before they were smarter than their cousins the chimpanzees, they had to improve their cooperation. Intelligence, language, culture—we owe all of these accomplishments to our sympathy and our ability to put ourselves in another's place. We humans became first the friendliest and then the most intelligent apes…. Cooperation that went beyond the biological family became possible and necessary.[7]

Semi-nomadic herding and hunter-gatherer societies still survive today, even if they are simultaneously integrated into aspects of the commodity economy. For example, until very recently, the !Kung (variously, Khoisan, Khoe-San, or San) of Southern Africa had hunted and gathered for tens of thousands of years. They are believed to be humankind's oldest continuously existing society. They have a high genetic diversity and at one time they may even have been the largest human population. The !Kung have a gendered division of labor, with women doing most of the gathering, providing some two-thirds of the calorie intake, and men doing most of the hunting. At the same time, there is a high level of equality between men and women.

Anthropologist Marjory Shostak summarizes her findings regarding the relationship between the sexes among the !Kung as follows:

> Here in a society of ancient traditions, men and women live together in a non-exploitative manner, displaying a striking equality between the sexes…. Other contemporary gathering and hunting societies have a similar high level of equality—higher at least than that of most agricultural or herding societies. This observation has led to the suggestion that the relations between the sexes that prevailed during the majority of human prehistory were comparable to those seen in the !Kung today.[8]

This has been confirmed by other studies, such as those of the Mbendjele BaYaka in Central Africa and the Agta of the Philippines, showing that equality between men and women is indicated not only by day-to-day behavior but also by the social structure of the hunter-gatherer bands and their living arrangements.[9]

The prominent role and behavior of women in such societies caused consternation and condemnation among colonial Europeans in the territory that became Canada. In the early seventeenth century, Paul Le Jeune, superior of the Jesuit mission at Quebec, spent many months in Eastern Canada learning the language of the semi-nomadic foragers of the Montagnais-Naskapi. It was his intention to civilize them. He was horrified by the sexual freedom in Montagnais society and describes one encounter:

> I told him that it was not honorable for a woman to love anyone else except her husband, and that this evil being among them, he himself was not sure that his son, who was there present, was his son. He replied, “Thou hast no sense. You French people love only your own children; but we love all the children of our tribe.”[10]

Studies of the !Kung people and other hunter-gatherer societies have found that “humility, humor, and strict protocols about distributing meat helped keep people on an even footing…. !Kung people traditionally downplay their accomplishments: A hunter will say he’s caught only a small skinny animal, even if it’s big and meaty, and his comrades will agree.”[11] Among the hunter-gatherer societies studied by anthropologists, “someone other than the successful hunter distribute[s] the meat.”[12] And the hunters of the !Kung “exchange arrows before they hunt. The owner of the

arrow, not the bowman himself, gets the credit and decides how to distribute the meat while everyone looks on."[13]

In such societies, the economy is a function of the social relations and people are not allowed to profit from trading transactions. Karl Polanyi got to the heart of the matter regarding hunter-gatherer societies when he explained, in 1944:

> The outstanding discovery of recent historical and anthropological research is that man's economy, as a rule, is submerged in his social relationships. He does not act so as to safeguard his individual interest in the possession of material goods; he acts so as to safeguard his social standing, his social claims, his social assets.[14]

In hunter-gatherer societies, social standing is gained by being helpful and cooperative. There is a tendency to suppress characteristics that are harmful to their own society: individualism, selfishness, greed, competitiveness, and aggression. They view these characteristics as counterproductive, even destructive, to the welfare of society.

Instead, these communities encourage and reward caring, empathy, cooperation, and sharing of food and other resources. There is nothing especially unusual or noble about people in hunter-gatherer societies (or contemporary indigenous communities). They are not inherently more environmentally conscious or socially just. These behaviors persist because they are foundational to the cultural survival and maintenance of their societies.

Horticultural Societies

Enormous climatic changes 16,000 to 12,000 years ago resulted in a warmer world; glaciers melted and retreated and rising seas inundated vast areas of land. New groupings of plants spread with the creation of new biomes. Soon after, around 10,000 years ago, during the last phase of the Neolithic period—the New Stone Age—a new form of human interaction with the natural world began with the domestication of animals and plants. Agricultural societies were highly varied, including many that never developed a class structure and continued to hunt and gather along with

growing food. People living in forests tended to practice shifting (slash-and-burn) farming with land cleared by felling trees and burning, farmed for a few years, and then allowed to regenerate forests for decades before being prepared once again for planting food crops.

Hunting-gathering bands consist of around 30 to 50 people with mostly informal and temporary leaders who exercise little power. Historian Yuval Harari suggests that once there are around 150 people living in the same community some more formal decision-making process is needed, because it becomes impossible to informally organize activities needed for life.[15] Although there were undoubtedly village leaders, such agricultural societies did not produce large food surpluses nor did they develop hierarchical class systems. The customs and traditions of such societies encouraged expression of traits and behaviors similar to those fostered by hunter-gatherer societies.

It was not so long ago—considering the 200,000 years of human existence—that native peoples in much of North and South America had a very different consciousness from that imposed by the invasions and conquests by European armies and settlers. Although the Inca and Aztec empires existed at the time of first contact with Europeans when the population of the hemisphere was 100 million, millions of people in the Americas lived in a variety of types of settlements, practiced both horticultural systems of growing food agriculture and foraging for plants and animals, and had ways of cooperative behavior similar to hunter-gatherer societies.

The economics of these societies often took the form of reciprocity and redistribution. Trade existed, using an extensive network of paths and roads over which people traveled far-and-wide. But trade was not for the sale of commodities for personal gain, but rather for exchange of goods. Agricultural land was not privately owned, nor could it be bought and sold. Instead, it was generally allocated and reallocated by village elders or community councils. Much of the food collected was redistributed at village ceremonial feasts. Leaders were chosen based on their generosity and ability to provide for others. These were not perfect societies, but the point is that people had different values, social mores, and “human natures.” Thus Christopher Columbus wrote after his first voyage to the Americas:

> Nor have I been able to learn whether they held personal property, for it seemed to me that whatever one had, they all took shares of…. They are so ingenuous and free with all they have that no one would believe it who has not seen it; of anything they possess, if it be asked of them, they never say no; on the contrary, they invite you to share it and show as much love as if their hearts went with it.[16]

The observations of a missionary working in the Caribbean in the 1650s is quoted by William Brandon, a leading historian of Native Americans:

> they are all equal, without anyone recognizing any sort of superiority or any sort of servitude…. Neither is richer or poorer than his companion and all unanimously limit their desires to that which is useful and precisely necessary, and are contemptuous of all other things, superfluous things, as not being worthy to be possessed.[17]

And French philosopher Michel de Montaigne wrote of the experience of three Native Americans who visited France in the late sixteenth century, and were struck in particular by the differences between the poor and wealthy:

> They had perceived there were men amongst us full gorged with all sorts of commodities and others which [were] hunger-starved, and bare with need and povertie begged at their gates: and found it strange these moieties [groups] so needy could endure such an injustice, and they tooke not the others by the throte, or set fire on their house.[18]

The Europeans who settled in the original thirteen colonies of the United States had no doubts about their superiority over the “savage” Native Americans they encountered. A comparison of the practices of Native Americans with those of the colonists provides evidence as to which society might justifiably be called savage.

The five nations comprising the Iroquois Confederacy, living in what is now Central New York and along the St. Lawrence River downstream to

Montreal, had democracy involving not political parties but people's participation in decision making and in removing unsatisfactory officials. Women voted with the men and had special responsibilities in certain aspects of life. Benjamin Franklin thought highly of Native American councils and their decision making. He observed, "All their Government is by Council of the Sages; there is no Force, there are no Prisons, no officers to compel Obedience, or inflict Punishment." [19]

At the same time, the so-called civilized settlers relied on white indentured servants and black slaves and severely restricted women's rights. It took another two and a half centuries after the Pilgrims landed and a civil war to end slavery, and three centuries and a long militant struggle for women to get the right to vote.

Compared to today's capitalist societies, those of pre-colonial America clearly had different social relations as well as relations to the resources they used. Prosocial behavior and basic gender equality were prominent features. But some agricultural systems around the world produced surpluses large enough to allow the development of non-farming classes as well as large settlements, even cities and empires. The traits and behaviors that became the norm in class societies were significantly different than those of hunter-gatherers and small agricultural societies.

The Development of Cities and Classes

Wherever new farming techniques with greater productivity resulted in production of significant amounts of surplus food, a layer of classes frequently developed: full-time craftsmen, merchants, priests, civil servants, soldiers, kings, queens, or other royal figureheads and families. Some societies, but by no means all, developed writing and metalworking as they grew into larger units, kingdoms, and empires.

The division into different classes in large agricultural societies varied over time and place, but it began with the rise of agriculture: slaves, lower castes, serfs, or peasants occupied the bottom rungs. The more socially privileged stratum of people developed into ruling classes as they came to identify their interests in acquiring more wealth and status, regardless of the conditions of lower classes.

With the growth of expansive agricultural societies with well developed class systems the treatment of women changed dramatically. Although a sexual division of labor existed in hunter-gatherer societies, the roles of women and men were seen as complementary and equally necessary. Some hunter-gatherer societies did exhibit inequality between the sexes, but unlike class-based societies this was far from a universal attribute.

However, in agricultural societies based on a plow pulled by animals such as those in Egypt, Mesopotamia, and China, as men became the field-workers and producers, women were removed from productive activities to exist within a new social structure in which their focus was on reproduction of the next generation of workers. Compared with Eurasian agricultural societies based on the plow, women in the Americas, even with the rise of cities and states, tended to help more with farming work and to have other roles such as weaving goods for tribute or trade that gave them a more prominent role in economic life.

The advantage of more reliable and greater food supplies came with disadvantages. Skeletal remains indicate that people in agricultural societies were not as well nourished as hunter-gatherers, who ate a much wider variety of foods; their height and life expectancy declined and they had to work significantly more hours per week in the fields than they ever had collecting roots, seeds, berries, and nuts. In addition to the declines in height and general nutrition and the negative impact on women with the rise of social hierarchies, there was another drawback to those societies that developed to rely exclusively on farming.

Agricultural productivity (output per farmer and per area of land) did not increase much because the technologies used remained mostly unchanged. Therefore, as populations of non-farming classes grew relative to the number of farmers and elites desired greater quantities of wealth, there was a need to expand the area under production or to conquer other peoples in order to extract greater quantities of surplus (tribute). This more socially privileged stratum of people developed into a social class when it begins to identify its own interests (in acquiring more wealth and status) as if they were the interests of the entire community. At that point, the interests of this proto-ruling elite diverge from the those of everyone else, as they attempt to force increases in productivity by those laboring directly on the

land, an increase in land area (through conquest), and a larger and docile labor force (slavery, kidnapping).

There is no pre-destined line progressing from egalitarian hunter-gatherer societies through mixed agricultural-hunting and gathering societies to city and state agriculture-based class ones. Human history is far more contingent and dependent on the people alive at the time and the decisions they made in the specific ecological, technical, historical, and cultural contexts. These various societies evolved in response to the problems that people faced, such as climate change, poor harvests, population growth, as well as to the opportunities that presented themselves, and the realization that harvested wild grain would reseed itself when dropped near the village or home granary.

Capitalism and Human Nature

Relations among people and between people and the rest of the natural world changed dramatically when economic and social relations were revolutionized with the appearance of capitalism. Private property, money, and trade for the purpose of immediate gain came to the fore; reciprocal obligations were eliminated; and social relations eventually became a reflection of the needs of capitalist economics.

Brought about by the forcible overthrow of previous societies, capitalism has existed for about 500 years, as industrial capitalism for the last 250 years. In other words, capitalism has been prevalent for less than 0.3 percent of the entire period that modern humans have walked the earth. In some parts of the globe, capitalism has held sway for an even shorter time period; in a few locations it has barely arrived.

Acculturation to society and its norms happens in many ways, much of it brought about through unconscious assimilation from the general culture. But behaviors can be instilled and reinforced beginning at an early age. Competition as a positive and “natural” behavior begins with childhood exposure to competitive sports and competition for grades and other rewards in school, then moves on to competition among adults for jobs, educational opportunities, social status, and housing. Businesses compete for market share, cities and states compete for new businesses, and

countries compete for export markets, geopolitical power, and access to resources.

Capitalism is characterized by competition. Cooperation is cultivated only so far as it reinforces and drives more competition. For example, corporations and countries may cooperate but only as a means to an end: so that larger and more powerful enterprises and states can vie for dominance more effectively against their competitors. The 2016 obituary for Dwayne Andreas, former CEO of the food-processing giant Archer Daniels Midland (ADM), quoted his comments at a 1990s meeting of American Sugar Alliance which perfectly capture a capitalist's view of competition: "A gazelle must run faster than the fastest lion or be eaten, he said. A lion needs to outrun the slowest gazelle or starve. 'It doesn't matter whether you are a lion or a gazelle,' he said. 'When the sun comes up, you'd better be running.'"[20]

Another characteristic of capitalism is the need to develop a culture of consumerism, the unnatural desire to acquire material goods. For the vast majority of human existence, "consumerism" was a concept that would not have made any sense, let alone be embraced as a real possibility. In the words of the economist John Kenneth Galbraith, capitalism is a system of "manufactured discontent." It is not some fixed innate compulsion, but rather a set of behaviors that capitalist societies develop and promote in order to continue selling products, as we discussed in chapter 2.

The emphasis on the specific assortment of characteristics and behaviors promoted by capitalism has detrimental effects on both communities and individuals. The authors of an article in *Psychological Inquiry* made this observation:

> Substantial evidence suggests that when the values and goals necessary for the smooth functioning of ACC [American corporate capitalism] become increasingly central to individuals and to institutions, the result is a corresponding conflict with three other aims: concern for the broader community and the world; close, intimate relationships; and feeling worthy and autonomous.[21]

We can conclude that human behaviors most commonly expressed in capitalist societies are starkly different from those in pre-class societies or

even prior class-based societies. For a society based on relentless competition, expansion, and warfare, greed and individualism must dominate the social and cultural mores of society and be justified ideologically as natural.

Human Nature and the Rich

There are those from every economic stratum who engage in antisocial behavior. Among the poor this is usually based on the need to eat or pay the rent; sometimes it's a result of activities that develop in high-unemployment areas where people have few ways out. But there are differences in average behaviors as one goes up or down the economic ladder and the poor generally tend to be more pro-social than the wealthy.

In capitalism, the rich, powerful, and greedy are our social as well as political leaders. They consider themselves to be the most important positive contributors to society, the so-called job creators and creative geniuses, thus explaining why they deserve to be paid so handsomely and receive the accolades and thanks of a grateful society. Greed is the emotion that most perfectly complements the economic compulsion toward continuous accumulation. Gordon Gekko's famous quote from the movie *Wall Street* accurately sums up the attitude of the newly minted rich in the 1980s, naturalizing greed as part of human evolution: "The point is, ladies and gentlemen, that greed—for lack of a better word—is good. Greed works. Greed clarifies, cuts through, and captures the essence of the evolutionary spirit." In 2017, we have a newly minted President who campaigned as the greedy candidate whose platform was greed as faith. At a rally in Iowa, he told his followers:

> I like money. I'm very greedy. I'm a greedy person. I shouldn't tell you that, I'm a greedy—I've always been greedy. I love money, right? But, you know what? I want to be greedy for our country. I want to be greedy. I want to be so greedy for our country. I want to take back money. [22]

Not only is greed considered to be good in a capitalist society it is an attribute necessary to guarantee the smooth working of the system. It is the

emotion that most perfectly complements the economic compulsion toward continuous accumulation.

While the wealthy have more control over their lives and live far more easily, such an existence that emphasizes and rewards greed corrupts their humanity, leading to antisocial attitudes and behavior. A 2012 article in the *Proceedings of the National Academy of Sciences* is titled: "Higher Social Class Predicts Increased, Unethical Behavior."[23] The authors found greed propels this behavior and that "relative to lower-class individuals, individuals from upper-class backgrounds behaved more unethically in both naturalistic and laboratory settings." One of the authors, Dacher Keltner, commented: "As you move up the class ladder, you are more likely to violate the rules of the road, to lie, to cheat, to take candy from kids, to shoplift, and to be tight-fisted in giving to others. Straightforward economic analyses have trouble making sense of this pattern of results."[24]

The capitalist economic system fosters misconduct in the affluent class in the pursuit of wealth and unethical behavior in general. As George Akerlof and Robert Schilling explain in *Phishing for Phools*, "every chance for profit more than the ordinary will be taken up" and "competitive markets by their very nature spawn deception and trickery."[25] In a 2014 article in the *New Republic*, Michael Lewis reports: "A UCLA neuroscientist named Keely Muscatell has published an interesting paper showing that wealth quiets the nerves in the brain associated with empathy: if you show rich people and poor people pictures of kids with cancer, the poor people's brains exhibit a great deal more activity than the rich people's."[26]

The antisocial ethics of the wealthy have to be effectively transmitted to their offspring for the system to replicate itself and the wealthy to stay wealthy. The greater the family income, the less altruistic the children will tend to be. According to one study:

> Our finding that family income negatively predicted altruism implies that this culture of self-focus could potentially be present in children as young as 4 years old who are from higher SES [socioeconomic status] backgrounds. The implication that their parents socialize greater self-interest in these children is consistent with findings that parents of higher SES value autonomy and

> individualism as socialization goals, whereas parents of lower SES are concerned with fostering respectfulness and obedience.[27]

Liberal economist Paul Krugman was correct when he summarized a number of these studies in his *New York Times* column by asserting, "Wealth can be bad for your soul."[28]

Businesses large and small act in unscrupulous ways, hoping that profit gains will outweigh any penalties and litigation costs they might have to pay. In the financial arena, the fallout from the Great Recession exposed significant problems: from Ponzi schemes, to banks pushing the sale of investments they knew were rotten (and that they were betting against), to banks cheating to make money on setting the LIBOR rates, to "liar loans" in which the mortgage originator fabricates information to make it appear that borrowers have the ability to carry the mortgage when they really don't, to robo-signing mortgage documents that were supposed to be signed by an actual person, to the sale of complex financial "instruments" that few, if any, actually understood, and on and on and on.

In an example from the manufacturing sector of the economy, in 2015 General Motors was ordered to pay a $900 million fine for hiding an ignition switch defect that caused the deaths of 124 people. In the same year, Volkswagen admitted to installing software in its diesel-powered vehicles that turned off emission controls in order to enhance car performance, causing the emission of forty times the U.S. legal limit of nitrous oxide (N_2O), a greenhouse gas which also depletes ozone in the stratosphere.

Among the many examples of corporate immorality with great consequences are the following: Exxon's forty-year cover-up of the effects on global climate change from fossil fuels; the tobacco and asbestos industries engaged in a decades-long cover-up of the negative health effects of their products; DuPont knew about the consequences of water contamination from poisonous chemical PFOA (perfluorooctanoic acid, aka C-8, used to make Teflon) but for many years it did nothing[29]; the Japanese company Takata was aware for more than a decade that its airbags were defective—and responsible for maiming and killing numerous people—but it wasn't until 2014 that they were forced to initiate an extensive recall; one that 3 years later is still underway. Figures provided in late 2016 indicate

that upwards of 42 million vehicles have been found with potentially defective Takata airbags in the United States and more than 7 million have been recalled worldwide, including 3 million in Japan. The cars affected included various models by Ford, BMW, Jaguar, Cadillac, Chevrolet, Volkswagen, Daimler, Chrysler, Honda, Acura, General Motors, Ferrari—basically the whole gamut of popular car manufacturers.

When such problems arise, the modus operandi of most corporations is to delay acknowledging and remedying defects and environmental damage for as long as possible. When they get caught violating health and safety laws that lead to the death or ill health of workers or pollution of the environment, corporate lawyers are on hand to minimize the financial costs and any damage to public image and brand, as well as delay litigation as long as possible hoping that the suit might be dropped.

No matter how many illegal activities committed by rich individuals or corporations we find out about, they recede into insignificance beside the social and ecological destruction caused by their perfectly legal day-to-day activities.

The system's need for CEOs to act in antisocial ways and not feel guilty tends to attract and retain those best suited to the role. According to recent research findings, psychopaths disproportionately populate the ranks of corporate leaders. Forensic psychologist Nathan Brooks and a team of colleagues studied corporate professionals in the supply chain management industry across the United States and found 20 percent of CEOs were psychopaths, compared to 1 percent in the general public.[30]

From toxic products to toxic effluent, from the deformation and shortening of people's lives to the degradation of the environment, the activities of corporations in pursuit of profits have few consequences under the legal, philosophical, and institutional setup of capitalism. The almost complete lack of criminal prosecution of CEO's for wrongdoing, and the inadequate or nonexistent fines of corporations that get caught, indicates that the legal system was set up to protect capitalists and corporations, not hold them to account.

If the rich are so "ethically-challenged," how do we understand their donations to charities (even though they donate a lower percent of their wealth than do people with less income and wealth)? Philanthropy is a booming business that helps the wealthy appear as social benefactors and

disguises the ecological and social damage they cause. Charitable giving by individuals and corporations makes them look and feel like benevolent patricians. In the process, they funnel money into areas that will make them look good while manipulating public policy. Corporate philanthropy and rich benefactors are an important ideological safety valve for the system that also provides the wealthy with lucrative tax write-offs. Charities and foundations do nothing to reduce inequality or human misery; they merely address some of the immediate symptoms without considering why such inequity exists in the first place.

Is Warfare Innate?

There is a material reason for a system-wide orientation toward war in class societies of any kind, the motivation for which does not exist in semi-nomadic bands without much property and with space to move elsewhere should conflicts arise. Nevertheless, there are those who believe that we humans, by our very nature, are innately aggressive, endowed with a built-in propensity toward violence, killing, and war. In fact, it's often thought of as a commonsense proposition: people are inherently warlike and drawn toward conquest and systematic violence.

Biologist E. O. Wilson writes of war as a phenomenon that transcends history, built into human DNA: "It should not be thought that war, often accompanied by genocide, is a cultural artifact of a few societies. Nor has it been an aberration of history, a result of the growing pains of our species' maturation. Wars and genocide have been universal and eternal, respecting no particular time or culture."[31] Indeed, Wilson goes so far as to argue that our predilection for violence stems from our evolutionary connection to chimpanzees, or even further back in prehistory: "There is a good chance that [tribal aggressiveness] could be a much older heritage, dating beyond the split six million years ago between the lines leading to modern chimpanzees and to humans."[32]

Wilson is far from alone. Based on his own studies of violence in chimpanzees, Harvard primatologist Richard Wrangham argues for an evolutionary propensity for violence we inherited from our closest genetic relatives dating back millions of years, "Chimpanzee-like violence preceded

and paved the way for human war, making modern humans the dazed survivors of a continuous, five-million-year habit of lethal aggression."[33]

For some scholars even the violence of ISIS is merely an expression of our ancient tribal imprinting toward brutality and warfare. In an article for the *Washington Post* titled, "How the Tribal Warfare of Our Ancestors Explains the Islamic State," Harvard scholar Luke Glowacki writes:

> My colleagues and I have been studying the origins of war through systematic analysis of chimpanzees, hunter-gatherers and modern conflicts. We have learned that lethal violence against out-groups is found, in one form or another, at all scales of society, including among our closest relatives, the chimpanzees.[34]

There are a number of problems with the story of chimpanzees as natural born killers ("data in support of these theories have been weak"[35]) that is supposed to back up the claim that the same is true for humans. While chimpanzees have been observed to use "lethal violence" against other chimpanzees, another close relative of chimpanzees and humans, bonobos, are known for their lack of aggression and resolving disputes peacefully, frequency by having sex. But there are even complications involving the contention that chimps normally partake in war or "lethal violence." Humans have destroyed so much of their habitat by logging and farming that chimp bands have no alternative but to live closer to other bands and to compete with them for resources. Thus, what is being observed are the interactions of animals living under very stressed conditions. One of the early examples of chimp aggression came from the fieldwork of Jane Goodall, who later recognized that the artificial conditions she had created were influencing behavior. She noted that:

> the constant feeding was having a marked effect on the behavior of the chimps. They were beginning to move about in large groups more often than they had ever done in the old days. Worst of all, the adult males were becoming increasingly aggressive. When we first offered the chimps bananas the males seldom fought over their food; … now … there was a great deal more fighting than ever before.[36]

As with chimpanzees, there is little evidence of early hunter-gatherer humans as violent and prolific killers. In an archeological study of 2,900 skeletons from over 400 sites that dated back to before 10,000 years ago only 4 bore "signs of violence."[37] John Horgan, describing the study in in *Scientific American*, concludes:

> The evidence is overwhelming that war, far from being an innate behavior that evolved millions of years ago, was a cultural innovation—an "invention," as Margaret Mead put it—that emerged relatively recently in our prehistory, toward the end of the Paleolithic Era. We should take responsibility for our wars instead of blaming them on our genes.[38]

Corroborating that study, a 2016 study published by the Royal Society of Great Britain on violence in Japanese society from 12,000 to 7,000 years ago shows that far from being omnipresent, it was an aberration, concluding that "violence including warfare in prehistoric Japan was not common."[39]

President Obama reiterated the theme that since humans have always engaged in warfare, continuing to wage war is normal. He did this in—of all places—his acceptance speech for the 2009 Nobel Peace Prize. He began his speech (while waging two wars) by addressing this dichotomy: "I come here … filled with difficult questions about the relationship between war and peace, and our effort to replace one with the other." Obama then went on to naturalize warfare as stemming from the very first human: "Now these questions are not new. War, in one form or another, appeared with the first man. At the dawn of history, its morality was not questioned; it was simply a fact, like drought or disease—the manner in which tribes and then civilizations sought power and settled their differences."[40] He then made a moral justification for why war is necessary as an instrument of policy, and amazingly, even a policy of peace: "There will be times when nations—acting individually or in concert—will find the use of force not only necessary but morally justified…. So yes, the instruments of war do have a role to play in preserving the peace."[41]

Clearly, under a variety of conditions, humans exhibit aggressive behavior, going so far as to kill other humans. And warfare continues to plague our species. But contemporary discussion of warfare as innate and,

therefore somehow acceptable, neglects the role of capitalist state national interests in waging wars such as those in Vietnam, Iraq, Afghanistan, and many more and absolves imperial intervention and conquest as just a part of "human nature." During the long human history before class societies, the preponderance of evidence indicates that peaceful dispute resolution was the norm.

Prosocial Traits and Behavior

The desire to act in ways that promote social well-being is deep within us. One of the earliest behavioral traits exhibited by infants is the desire to help others. A review of research on these early developments concludes:

> Young children help those for whom they feel sympathy; they are not motivated by extrinsic rewards; and they are less concerned that they provide help than that the person in need be helped. Young children's prosocial behavior is thus intrinsically motivated by a concern for the other's welfare, which has its evolutionary roots in uniquely human forms of social and cultural interactions in which individuals are concerned about the well-being of those with whom they are interdependent.[42]

There is well-documented and widespread evidence of psychological and physical benefits to helping others. For example, researchers at the University of British Columbia have shown that when people are given money and asked to use it generously, it "enhances one's own happiness, and that the benefits of such 'prosocial spending' hold up around the world, from the United States and Canada to Uganda and India…. People assigned to use the money in generous ways showed a significant reduction in blood pressure … similar in magnitude to what is typically observed when people start engaging in regular aerobic exercise."[43]

Prosocial behavior and traits are often suppressed by the need to express those contrary behaviors required to survive and flourish within the system of capital. However, even where antisocial capitalist social relations are prevalent, there are expressions of the deep human values of empathy, solidarity, and cooperation. Though latent, they rise to the fore during

natural disasters and periods of mass resistance such as strikes and anticolonial struggles. In her study of how people react in the wake of natural disasters, writer and activist Rebecca Solnit concludes:

> The history of disaster demonstrates that most of us are social animals, hungry for connection, as well as for purpose and meaning…. Two things matter most about these ephemeral moments. First, they demonstrate what is possible or, more accurately, latent: the resilience and generosity of those around us and their ability to improvise another kind of society. Second, they demonstrate how deeply most of us desire connection, participation, altruism and purposefulness.[44]

That prosocial behavior still occurs despite the many rewards of capitalist society for anti-social behavior and that humans naturally lean against individualism is a strongly hopeful sign. It is one more indication of the wide range of human characteristics within each of us, our tendency toward empathy and care for others. It raises the issue of how a future society would best encourage prosocial behavior while discouraging anti-social behavior.

So What Is Human Nature?

There is no such thing as a hard-and-fast human nature. To assert otherwise is to promote a position based not on science or the history of our species but on ideology. The specific set of traits and behaviors encouraged in our society and referred to as "human nature" is a sociological, historical, and political question, not a biological reality. Over the millennia since *Homo sapiens* emerged as a species there have been many different kinds of societies, with various types of cultures, social organization, and relations among humans and between humans and the resources that we use to perpetuate our existence.

It is evident that the concept of an inbuilt human nature is not a useful indicator of what it means to be human. Thus it makes no sense to refer to a "human nature" apart from the context of a particular society. As Marx wrote, "All history is but the continuous transformation of human nature."[45]

We humans are not a tabula rasa—a blank slate capable of being imprinted and conditioned to unquestioningly accept whatever propaganda we are fed. In some situations, people can certainly be manipulated to believe false ideas, but our primary assets as a species are our ability to learn and our flexibility, which can lead to changes in thinking as well as action.

Human behaviors and traits have changed before and can therefore change again. To reach a truly just and ecologically healthy world, they *must* change to enable prosocial behavior patterns to become dominant, and antisocial behavior, so prized and rewarded in capitalist societies, to fade into the background. The question to address, therefore, is not *whether* human values and relations can change, but *how* they change, as part of a transformation of our society into a more humane and ecological social organization.

7

Equality as Biological Fact

> Human equality is a contingent fact of history. Equality is not given a priori; it is neither an ethical principle (though equal treatment may be) nor a statement about norms of social action. It just worked out that way.
>
> —Stephen Jay Gould[1]

Humans, as a part of the natural world, derive our sustenance from working with the external environment, live in many different types of societies with a variety of social norms, display a wide range of traits and behaviors that are shaped by and interact with local environmental conditions as well as the stimuli of the society in which we live. There is no such thing as a fixed set of human traits and behaviors that are displayed equally in all societies. No group is innately intellectually or morally superior to another. We are *not* compelled by our biology to act in antisocial ways—to be greedy, selfish, and competitive, for men to dominate women, for whites to discriminate against people of color. Rather than being written in our genes, racism, sexism, and other forms of discrimination and oppression are the creation of unequal societies. The future is therefore open to the creation of a genuinely equal society.

We are a very young species with a small founding population. This helps to explain the low genetic variability among randomly selected humans, around 0.1 percent. And most of that small 0.1 percent variation, some 85 to 90 percent, is found within populations from the same continent; about 10 percent more than among a collection of people from Asia, Africa, and Europe.[2] "As a species, *Homo sapiens* is more homogenous (there is

less genetic variation) than in a typical wild population of chimpanzees. And in the place where we all began, Africa, populations in Congo, Ethiopia, and South Africa are more different from each other than each is from the population in northern Europe."[3]

Individuals within a given population vary in capabilities (social, physical, intellectual) depending on a host of factors, including family circumstances, economic conditions, available opportunities for education and healthcare, genetic inheritance, life experiences, motivation and interests, even birth order. However, one of the myths perpetuated is that there are distinct human groups with various observable traits that have differing intellectual and social abilities. In this chapter, we will discuss race as a political invention; we will also look at several studies that posit that hormones and the architecture of the brain are accountable for gender differences. Finally, we will discuss these findings in the context of epigenetics, indicating that there is an intimate interaction between the environment and how genes are expressed.

The Political Invention of Race

Race has no foundation in biology. But the *idea* of race and its all-too-real consequences through systematic and pervasive racism in all areas of life persists because it is useful to a system that thrives by differentiating people into unequal and competing groups. This works to perpetuate ruling elites and their positions of power in capitalism—the more divisions and disagreements there are among people, the less possibility of united actions that might challenge the system.

"Race," as it emerged in capitalist societies, is an invention of a political system that governs by sorting people into social groupings. It is a political category that has been disguised as a biological one.[4] Despite the absence of scientific evidence for the existence of biologically separate "races," classification of people into supposed races continues to be used to attribute capabilities and behaviors to various groups, with the many adverse social consequences we discussed in chapter 4.

In their 2012 book *Racecraft: The Soul of Inequality in American Life*, Barbara and Karen Fields describe how distorted thinking about race can

be:

> *Racism*, something the oppressor *does*, [is transformed] into race, something the target *is*, in a sleight of hand that is easy to miss. Consider the statement "black Southerners were segregated because of their skin color"—a perfectly natural sentence to the ears of most Americans, who tend to overlook its weird causality. But in that sentence, segregation disappears as the doing of segregationists, and then, in a puff of smoke—paff—reappears as a trait of only one part of the segregated whole.[5]

The existence of racism means that people are viewed through a distorted lens, leading to mistaken assumptions regarding cause and effect. For example, assuming that race is a biological reality encourages scientists to search for genetic explanations for the high incidence of diseases such as asthma or hypertension among the African American population. However, the cause for the high incidence of these diseases is racism and the resulting stresses and environmental contamination in African American communities. It is a similar issue for the supposed differences in intellectual abilities between supposed races.

Scientific racism has a long history, but it resurfaced in the 1990s with the publication of *The Bell Curve: Intelligence and Class Structure in American Life*, by psychologist and Harvard professor Richard Herrnstein and influential political scientist Charles Murray. *The Bell Curve* used performance on IQ tests as supposed proof that there are real differences in intelligence between different races as well as classes, that are definitively based on genetics and environmental factors.

In 2015, Murray continued to argue that IQ scores of children correlate with their parents' IQ as well as with their family economic status. Differences in family economic status are therefore justified by such findings because they are but a reflection of ability. Using his circular argument, Murray wants us to acknowledge the reality of differences in supposedly innate intelligence so that we help "children whose strengths do not lie in academics" do something else.[6]

There are many problems with such experiments and how they are interpreted. Any kind of test is stressful for children, particularly if one

knows it's supposedly testing how smart you are. There is a tendency for students to perform up to, or down to, expectations. As a 2015 *Scientific American* article explained:

> Decades of science have shown that pervasive stereotypes of certain identity groups as less intelligent or less capable in academics often lead students of these groups to worry that they could be judged through the lens of these negative stereotypes. This threat is stressful and can undermine these students' learning, performance, and engagement…. When we give students exercises designed to reduce stereotype threat, we see their school performance and engagement increase, and the racial achievement gap shrinks.[7]

As other researchers have found, poor test performance "results not from the content of performance measures, but from the context in which they are assessed—from psychological threats in common academic environments, which depress the performances of people targeted by negative intellectual stereotypes."[8]

Despite the problems inherent in differentiating people based on tests, the whole idea that something as complex as intelligence can be measured by a simple test is absurd, especially one in which knowledge that a person previously acquired is needed to do well. As a British researcher put it in 2013, "I can report hard evidence of what most of us have suspected all along: previously reported links between general intelligence and 'race' are bunkum."[9] The very idea of testing for racial difference is itself racist. Science tells us that there is only one race of our species, the human race.

In the face of the results of all research that finds against any biological definition of race and all evidence showing it to be entirely socially constructed, racism justified through science is far from dead and continues to crop up as a biological explanation for inequality. In 2014, Nicholas Wade, longtime science writer for the *New York Times*, published *A Troublesome Inheritance: Genes, Race, and Human History*. Contrary to all genetic evidence, he maintains that there are three distinct human races: Africans, Caucasians, and East Asians. According to Wade, not only do these races have distinct phenotypes (that is, they look different), they have different genetically determined behavior patterns.

Wade argues it was genetics, and not specific historical developments, that allowed the people in Western Europe to develop more open societies with legal frameworks that protect private property and promote business interests—perfect for the development of capitalism. This is why some countries remain poor: they just don't have the right genes.[10]

The real reasons why some countries, regions, or groups of people are "underdeveloped" are simply ignored. Many of these countries were exploited for centuries, first as colonies and sources of slaves and later by commercial ventures seeking resource extraction and cheap labor. As a result, their societies were destabilized and people were killed and displaced during colonial and imperial interventions. Today, countries of the Global South have to compete with the power of giant corporations headquartered in the advanced capitalist countries and buttressed by their governments and "free trade" agreements written to favor their business interests. This is the reason it is so hard for the poorer countries to grow their economies in a world in which the game has been rigged to favor large corporations in the wealthy countries.

In the United States, centuries of slavery followed by racism and discrimination in all areas of life have prevented the equal participation in society of African Americans. This inequality is not a consequence of genetic differences between African American and white populations, but a result of historical and economic, social, and political conditions created by those in power.

Women and Biological Determinism

The same can be said for the systemic inequalities experienced by women. Since its publication in 1992, John Gray's best-selling book *Men Are from Mars, Women Are from Venus*, has sold over 50 million copies worldwide. The book portrays psychological differences between the sexes as being so extreme, they appear to originate from vastly different sources, which then manifest in behaviors that are incomprehensible to the other gender. Examples of supposedly fundamental psychological differences Gray gives include how when stressed, men retreat "to their cave" and women "need to talk."

In her bestselling 2006 book, *The Female Brain*, Louann Brizendine, a neuropsychiatrist and founder of the Women's and Teen Girls' Mood and Hormone Clinic in San Francisco, reports that many differences between male and female behavior can be attributed to hormones: "What we've found is that the female brain is so deeply affected by hormones that their influence can be said to create a woman's reality. They can shape a woman's values and desires, and tell her, day to day, what's important."[11]

Brizendine conducts a series of case studies reflecting nearly every stereotype about men and women and said she was surprised to discover just how affected women's behavior was by the presence or absence of certain hormones. She argues that *not* understanding the effects of hormonal cycles is itself dangerous because women end up blaming themselves. She notes, crucially, that 80 percent of women are only mildly affected by hormone fluctuations, and that "a hormone alone does not cause a behavior. Hormones merely raise the likelihood that under certain circumstances a behavior will occur."[12]

There have been other studies like Brizendine's that propose that the divergent ways that men and women interact with the world are a matter of differences in brain chemistry. For example, in 2013, a team of researchers at the University of Pennsylvania mapped the neural connections in the brains of hundreds of males and females aged eight to twenty-two. A reporter describing the research suggested that the scientists found that "stark differences exist in the wiring of male and female brains."[13]

The study's chief researcher, Ragini Verma, commented to the *Guardian*'s science correspondent that the team's results "surprisingly" validated gender stereotypes. Yet, despite all the much-hyped claims of differences in cognition assigned to gender, they are repeatedly found to be trivial and socially constructed such that "our minds, society, and neurosexism create difference. Together they wire gender. But the wiring is soft, not hard. It is flexible, malleable and changeable."[14]

Professor Dorothy Bishop of Oxford University, commenting on the University of Pennsylvania study, noted that the authors act "as if there is a typical male and a typical female brain—they even provide a diagram—but they ignore the fact that there is a great deal of variation within the sexes in terms of brain structure. You simply cannot say there is a male brain and a female brain."[15]

Bringing together ideas about the construction of race and gender and the social suppositions they rest on, biologist Anne Fausto-Sterling argues, "Ideas about race and gender emerge from underlying assumptions about the body's physical nature. Understanding how race and gender work—together and independently—helps us learn more about how the social becomes embodied."[16] Fausto-Sterling goes on:

> Our bodily experiences are brought into being by our development in particular cultures and historical periods. But especially as a biologist, I want to make the argument more specific. As we grow and develop, we literally, not just "discursively" (that is through language and cultural practices), construct our bodies, incorporating experience into our very flesh. To understand this claim, we must erode the distinctions between the physical and the social.[17]

Peter Dorman creatively demonstrated the absurdity of the research on gender differences in abilities supposedly caused by genetics. Commenting on a scientific article on differences in reading, mathematics, and science, he wrote sarcastically:

> This proves what many of us have suspected all along: boys are genetically inferior when it comes to reading, at least *careful* reading. Their brains are not wired for words. So stop trying to make excuses for things like guys failing to understand mortgage contracts or IPCC reports on climate science. This is not a social failing; it's because of evolutionary inheritance. Back in the cave age, males who got absorbed in reading were eaten by sabretooths or something. Pretending that biological differences don't exist is just Political Correctness, and we know how horrible that is.[18]

Women and the Sciences

It remains common to consider it a part of human nature or brain structure that women are supposedly not able to competently perform certain tasks, such as those needed by medical doctors. In 2005, Larry Summers, president of Harvard University at the time, remarked that "in the special

case of science and engineering, there are issues of intrinsic aptitude and particularly of the variability of aptitude" that explain the underrepresentation of women in these fields.[19] These comments—presumably referring to assumed differences in brain structure and function that mean that women can't think as well in math and science as men—show that a strong ideological view of a gendered human nature still exists. A decade later, Nobel Laureate Sir Timothy Hunt, a biochemist, argued that science laboratories should be segregated so that female scientists would not distract their male colleagues: "Let me tell you about my trouble with girls … three things happen when they are in the lab…. You fall in love with them, they fall in love with you and when you criticize them, they cry."[20] Though Summers and Hunt ultimately lost their jobs, their prejudices are endemic to academia.[21]

Biased hiring and promotion practices are widely practiced among the science faculties of educational institutions. A 2012 study by social psychology researchers at Yale University found that science professors, male and female, consistently preferred male professors for mentoring positions or jobs. Women hires were offered salaries $4,000 lower than identically qualified male candidates. The pervasiveness of the bias was considered to be due to subconscious cultural attitudes inculcated throughout a lifetime saturated in a sexist culture, and not to individual, conscious prejudices.[22]

During the early to mid-twentieth century, women worked against formidable odds to get opportunities to become scientists. When they did, their work was either ignored or co-opted by others without proper credit. There are countless examples of this. For example, the research by the remarkable plant geneticist Barbara McClintock (1902–1992), showing that corn genes or parts of genes could change location on chromosomes during cell division, was largely ignored. For many years the phenomenon of "jumping genes" was mainly considered an eccentric curiosity or oddity. The findings that some 50 percent of the human genome and as much as 80 percent of the corn genome are composed of what are now called "transposable elements" indicate the significance of McClintock's research, for which she was belatedly awarded a Nobel Prize in 1983.[23] McClintock's later work on epigenetics, heritable changes not caused by changes to the DNA sequence,[24] is another indication that she was ahead of her time.

The work of the English chemist and crystallographer Rosalind Franklin (1920–1958) provided critical evidence for ferreting out the structure of DNA. James Watson and Francis Crick essentially appropriated Franklin's work and originally did not even acknowledge the significance of her contribution to "their" discovery. Crick has since died, but Watson, who as a world-famous geneticist really should know better, has become infamous and a pariah within the scientific community for his openly espoused racist and sexist bigotry.[25]

Ada Lovelace is recognized by many as the world's first computer programmer. But Lovelace's notes on Babbage's analytical engine gained little attention when they were originally published in 1843 (under her initials A.A.L.). It wasn't until they were republished in B.V. Bowden's 1953 *Faster Than Thought: A Symposium on Digital Computing Machines* that her work found a much wider audience.

All six primary programmers for the first modern computer, ENIAC, were women—Kay McNulty, Betty Jennings, Betty Snyder, Marlyn Wescoff, Fran Bilas, and Ruth Lichterman. They are most often referred to as "computers" and "the ENIAC Girls." They too, received little attention at the time they worked; programming was undervalued precisely because it was done almost entirely by women. These women weren't even invited to the dinner following the announcement that the machine worked in 1946.

Katherine G. Johnson, an African American woman who grew up in deeply segregated West Virginia, was one of NASA's "human computers" in the 1950s. She is credited with developing the calculations for numerous space flights that took place during the 1960s, and when electronic computers began to be used, "they asked Johnson to double-check the computer's work." She co-authored the paper that provided the mathematical basis for orbital flights, "Determination of Azimuth Angle at Burnout for Placing a Satellite over a Selected Earth Position," and was responsible for calculating the path of the Apollo 11 trip to the moon.[26] Although her skills got her equal footing on the job with all-white male mathematicians, Johnson still had to deal with segregation in the workplace, including using separate bathrooms and places to eat.

Institutionalized gender bias promotes the notion that aptitudes in math and the sciences are incompatible with women's natural abilities. Moreover, characteristics associated with leadership are viewed as incongruent with

women's gender roles. Promotion is still biased toward male academics, mothers are viewed as less competent in the workforce than women who are not mothers, women who appear more "feminine" get passed over for opportunities and promotions, and the list of studies showing institutional bias against women continues to grow. A study at Stanford University even shows that although there have been significant gains by women in math and science, scientists are still pictured as overwhelmingly male and white—that is, children tend to depict scientists as male and white, even though the number of female and nonwhite scientists has been steadily increasing.[27] And findings of research on the development of gender stereotypes in children indicates continuing challenges: "Many children assimilate the idea that brilliance is a male quality at a young age. This stereotype begins to shape children's interests as soon as it is acquired and is thus likely to narrow the range of careers they will one day contemplate."[28]

Unequal opportunities and treatment by race and gender have nothing to do with genetics, brain structure and chemistry, or hormones. They are a result of economic, social, and political conditions created and maintained by a system that benefits from these inequities.

Epigenetics and the Interaction of Environment, Organism, and Genes

The more we learn about genetics and the role of DNA, the molecule that holds the code for most of the basic functioning of cells, the more biological determinism becomes untenable. Despite the best attempts of ideologues to show otherwise, the idea that humans have genetically determined social traits and talents that determine who they will be and how successful they will be before they're even born has been clearly debunked. Many environmental stimuli affect the functioning of our cells and bodies in ways that are only now beginning to be understood.

The study of the chemicals that are attached to genes in our DNA is called epigenetics. Established as a new field of study in the twenty-first century, scientists have found that the attachment of a methyl group (CH_3) to DNA affects the degree of *expression* of genes. In addition, changes in the surface chemicals on histones—the protein bundles that the

chromosomes wrap around—also influence gene expression. The chemicals attached to genes and histones determine whether a particular gene will function to make a protein and, if it does, how much it will make. “Like a computer, DNA is impotent without its software, the epigenome, telling it when, where and how to work.”[29]

Although it is still a young field of study, epigenetic research has indicated:

1) A number of factors, including exposure to airborne pollution and a variety of other chemicals in the environment as well as psychological and material stress, can cause changes in the epigenome.
2) Some of these epigenetic changes are implicated in a range of diseases, including cancer as well as other serious health conditions.[30]
3) These epigenetic changes can be passed along to offspring, affecting the lives of their children or grandchildren.

Studies of genetically identical mice in different environments have shown some surprising results. One group was observed over a three-month period in an intricate environment of great diversity, while another group of control mice were kept in plain cages. Even though the mice were all genetically identical and behaved similarly at the beginning of the experiment, their exploratory behavior was markedly different by the end. Mice that moved around a lot and explored grew new nerve cells in the hippocampus, an area of the brain influenced by environmental complexity. In other words, *the brain structure of genetically identical mice changed as a result of their life activity*.

As the researchers pointed out, these changes come about because of contingent facts in the mouse’s life, highlighting the plasticity of the brain:

> Different experiences might modify gene expression by changing the control systems in a cell’s DNA. Such changes are known to happen in human identical twins as they age. Other factors that might generate individual differences in genetically identical animals include intrauterine position during fetal development, nutrition, maternal stress, and early postnatal events, such as a researcher handling individual mice. Finally, there is mere chance. If

the mice entered the cage in the same general spot, some might have been on the outside of the crowd, others on the inside.[31]

The field of epigenetics has added a new dimension to the outdated nature versus nurture debate, underlining just how wrong the proposed dichotomy was in the first place. The genes, as well as chemical markers attached to the DNA that are present as a result of environmental influences (chemical, physical, and social), combine to influence much of what happens with respect to human well-being and development. The stress effects of poverty, maltreatment, being constantly reminded that you are "the Other," and exposure to toxins have a negative influence on individuals directly subject to those factors. Furthermore, we now know those negative impacts can be passed on to our progeny.

The idea of either nature or nurture, or some percentage of each, determining our behavior and development has always provided an incomplete and inaccurate account of how genes, organism, and environment interact. How should we understand the interaction of organism and environment? Biological determinism holds that everything about an organism is set from birth by its genetic makeup. Alternatively, the organism is a blank slate, ready for environmental imprinting. These static and one-sided accounts are sometimes melded to hypothesize a certain percentage of each, genes and the environment, that determines the organism's life track. None of these explanations are satisfactory, however, as they fail to capture the dynamic and reciprocating interaction between all three factors: gene, organism, and environment. In the case of humans, our environment is social as much as it is chemical and biological.[32]

IN SUMMARY, HUMANS, AS A PART of the natural world, derive our sustenance from working with the external environment, live in many different types of societies with a variety of social norms, display a wide range of traits and behaviors that are shaped by and interact with local environmental conditions as well as the stimuli of the society in which we live. There is no such thing as a fixed set of human traits and behaviors that are equally displayed in all societies.

No group is innately intellectually or morally superior to another. We are *not* compelled by our biology to act in antisocial ways—to be greedy,

selfish, and competitive, for men to dominate women, for whites to discriminate against people of color. Rather than being written in our genes, racism, sexism, and other forms of discrimination and oppression are the creation of unequal societies. Confirming Anne Fausto-Sterling's assertion that "we must erode the distinctions between the physical and the social," recent scientific research illustrates even further how subject to change humans and other species are, depending on how we live our lives and the type of environment to which we are subjected. The issue isn't unequal innate abilities or behaviors of different groups of people (which are nonexistent) but rather the damage done to people by societal inequity. Rather than being written in our genes, racism, sexism, and other forms of discrimination and oppression are the creation of unequal societies. The future is therefore open to the creation of a society of genuine equality; there is nothing in our biology to constrain or derail its blossoming.

As biology can inform us about social impacts of unequal treatment and conditions on people, broad ecological knowledge of the natural world offers insight as to how we might bring about a genuinely sustainable society. It is to this exploration that we turn in Part Three.

PART THREE

Learning from Nature

8

The Biosphere: Cycles of Life

> In nature nothing takes place in isolation. Everything affects and is affected by every other thing, and it is mostly because this manifold motion and interaction is forgotten that our natural scientists are prevented from gaining a clear insight into the simplest things.
>
> —Frederick Engels[1]

All living creatures interact with other species and their surroundings. The degree of stability and the amount of biomass productivity of an ecosystem are related to the complexity of these relationships.

Ecosystems are composed of assemblages of living organisms, including those living within and on the surfaces of other organisms, all interacting among themselves as well as with their habitat—the water, the air, soil, and climate. Large geographic areas containing communities of plants and animals adapted to a particular environment (especially climate and soils) are referred to as biomes. These overlap in transition zones known as ecotones, which frequently exhibit greater biodiversity than each individual biome of which they are composed.

Many think of particular ecosystems or biomes as isolated islands. However, biomes interact, for example, with birds and insects seasonally migrating from one biome to another. Disparate biomes, in location and type, may impact one another over distances of thousands of miles, as is the case with the Amazon, which is fertilized with dust from storms originating in the Sahara and with weather systems that begin off the coast of West Africa and emerge as hurricanes in the Caribbean.[2] Another important

interaction between biomes occurs when sediment-laden rivers flow out of mountain forests, depositing their loads in valley floodplains. Thus the biosphere as a whole and the various biomes are open systems with exchanges of organisms, minerals, water, and gases constantly occurring.

If we focus only on individual species our knowledge remains incomplete. Doing so overlooks emergent properties of ecosystems—those attributes unexpectedly arising out of species interactions and holding many lessons for humanity. Though acknowledging inter-connectedness, we still need to separate out and focus on various phenomena to gain a better understanding of how the planet operates.

A better understanding of the multitude of effects and mechanisms that organisms use to help them thrive under particular conditions, including working in conjunction with other organisms, can help us design more sustainable ways to meet our needs.

Cooperation and Life

The world is in a constant state of change. When an organism goes about its normal life activities it changes its surroundings as well as itself. As soil minerals dissolve in water, both the minerals and the water are changed in the process. As the Greek philosopher Heraclitus wrote some 2,500 years ago: “No man ever steps in the same river twice, for it’s not the same river and he’s not the same man.” The water molecules that passed by the first time are long gone by the time one steps in again. Likewise, one can never walk into the same forest twice. Walking in the forest creates measurable biological and chemical changes: the soil under your footsteps is different from before you took that step. The passage of time also causes chemical and physical changes in each person, including changes in mental states; the memory of a prior walk alters how we perceive a future one.

One of the central concepts of Darwinian evolution is variation through natural selection, a process commonly reduced to the phrase “survival of the fittest.” This is typically misunderstood as the single defining feature of evolutionary theory. This concept is widely promulgated in our society because it fits so well with the ideology and practice of competition in capitalism. People and institutions are encouraged and compelled to

compete and rewarded for their success. Whichever businessperson thrives while others flounder is by definition the fittest capitalist.

Though much less studied, cooperation within and among species is just as critical as competition to the process of evolution. Cooperation, which was critical for survival of the hunter-gatherer societies that prevailed for most of our existence, is one of the keys to the evolution and success of our species as well as many others.

"Nature nurtures life through communities," says Fritjof Capra, physicist, author, and cofounder of the Center for Ecoliteracy. "This is a process that started with the first single-celled organisms. Life … took over the planet by networking, not combat."[3] Cooperation, which takes many forms between and within species, is common throughout the history and scope of the four-billion-year-old story of life on this planet.

Cooperation exists everywhere; for example, a number of species of microorganisms tend to live "in complex communities, where they communicate with one another to cooperate for the greater good."[4] When a critical population of many bacteria is reached they exude sticky material that makes a protective mat or biofilm that they live within. Inside multicellular organisms, the various types of cells are not in competition under normal healthy conditions but rather receive assistance from other types of cells—as when red blood cells deliver oxygen from the lungs throughout our bodies.

In plants, nitrogen-fixing bacteria create a home inside the roots of legumes, obtaining sugars from the plant in order to live and providing nitrogen to the plant in a form it can use. Large populations of microbes living near plant roots, an area called the rhizosphere, receive sugars and other compounds exuded from roots and provide the plant with soluble forms of phosphorus and a variety of organic substances that stimulate plant growth.

Similarly, there is intimate cooperation between certain fungi (mycorrhizae) and plant roots in which plants supply fungi with energy-rich compounds while the fungi help the plant obtain water and nutrients in the soil. The fungi even help plants exchange organic compounds. One study in a forest indicated that some 40 percent of the carbon in fine roots originated from the photosynthesis of neighboring trees.[5] Trees also signal one another using the underground network of connecting mycorrhizae to warn of insect

attacks. Nature is full of such examples: bees pollinating flowers as they obtain pollen, fish known as “cleaner fish” eating parasites from the mouths of other fish, cattle egrets and cowbirds eating flies and bugs from the backs of cattle. Clearly, cooperation is one of the most important ways that species and individuals within species interact.

Certain structures common to eukaryotes (all cellular life with DNA enclosed in a nucleus) such as the chloroplasts in green plants, the energy-converting mitochondria found in all plant and animal cells, began as free-living organisms that became incorporated into the normal workings of larger cells. In these instances cooperation led to some organisms being integrated into cells of another, resulting in the creation of new organisms. According to Martin Nowak, director of the Program for Evolutionary Dynamics at Harvard University and an internationally recognized scholar on evolution and game theory:

> Co-operation was the principal architect of 4 billion years of evolution. Co-operation built the first bacterial cells, then higher cells, then complex multicellular life…. Co-operation can draw living matter upward to higher levels of organisation. It generates the possibility for greater diversity by new specialisations, new niches and new divisions of labour. Co-operation makes evolution constructive and open ended.[6]

In order to grow, exist, and reproduce, all living organisms need *sources* of essential materials and *sinks* that can absorb their wastes—which are in turn frequently used as sources of energy and nutrients by other organisms. As organisms go about their lives, the biochemical processes are commonly grouped together under the term *metabolism*. This includes production or synthesis of materials—such as proteins, carbohydrates, and fats for growing new tissue and storing energy—as well as the breakdown of substances to produce energy and to provide chemical building blocks to make other molecules, repair damaged tissue, and reproduce. The chemical and biological surroundings of organisms and the organisms themselves are changed by resources they use and by the release of waste products.

As discussed in chapter 3, Karl Marx used the word *metabolism* in an enlarged sense to describe the interactions between humans, our social

system, and our physical, biological, and chemical surroundings.

The interaction of living organisms with the non-living as well as the living part of the world was highlighted by Engels: “Animals … change the environment by their activities in the same way, even if not to the same extent, as man does, and these changes, as we have seen, in turn react upon and change those who made them.”[7] The same can also be said of plants, as they remove nutrients and water from soils, depleting these substances, even if only temporarily, making it more difficult to obtain their basic needs in the future if the nutrients and water are not replenished. There is a continuous exchange of matter and energy among organisms and between organisms and the biosphere.

In many interactions, species cooperate to make life possible. However, there are other types of cooperation, such as signaling interactions; for example, most plants give off gaseous substances when attacked by insects, thereby stimulating their neighbors to start making defense chemicals to help withstand a similar assault.

To Shape and Be Shaped

Striking examples of a species interacting with the rest of the environment took place long before multicellular life evolved, illustrating the extraordinary environmental changes caused by living organisms. In a very real sense, the physical earth and the biological inhabitants created each other and evolved together. Oxygen is far too reactive a gas to have existed in the early atmosphere of our planet. Any small amount of oxygen that might have been produced would have been rendered insoluble and unreactive by combining with other elements such as iron. Because there was none in the early atmosphere, something must have put oxygen there and brought it up to a relatively high level.

It was a single-celled bacterial species that brought about this singularly significant change. Cyanobacteria emit oxygen as a byproduct of photosynthesis, as do the terrestrial plants that developed much later in evolutionary history.

Cyanobacteria, often referred to as blue-green algae, are capable of photosynthesis and nitrogen fixation, providing the organism with energy,

the complex carbon-based molecules it needs, and nitrogen in forms that can be used to make amino acids and proteins. “Cyanobacteria are arguably the most successful group of microorganisms on Earth. They are the most genetically diverse; they occupy a broad range of habitats across all latitudes, widespread in freshwater, marine and terrestrial ecosystems, and they are found in the most extreme niches such as hot springs, salt works, and hypersaline bays.”[8] While not the only nitrogen-fixing organism present, a filamentous form of cyanobacteria, *Anabaena azollae*, is important for maintaining nitrogen fertility in rice paddies that have been farmed for centuries.

The production of oxygen by oceans full of cyanobacteria 2 billion years ago created the oxygenated atmosphere that earth has had ever since. (It is thought that the current level of atmospheric oxygen—around 21 percent—was reached only 400 million years ago, after land plants colonized the earth.) As a consequence of the production of so much oxygen, organisms that evolved earlier and were then living in direct contact with the atmosphere had no way of coping with high concentrations of oxygen and were decimated.

This large die-off simultaneously created the opportunity for the evolutionary development of organisms that require oxygen, including multicellular forms of life. Today, anaerobic organisms require an oxygen-free environment such as in lake or ocean sediments or inside our digestive tracts.

“In nature nothing takes place in isolation,” Engels’s important insight, is now a core principle of ecology. Studying cells or individual organisms separate from this reality can produce important understandings and knowledge. However, that reductionist approach is a major obstruction to advancing an understanding of our world in all its complexity. The real ecological action takes place as organisms interact with other organisms and their surroundings. As they do so, properties emerge that the individual organisms don’t have by themselves. For example, while nitrogen-fixing rhizobia bacteria and legume plants can live without each other and can be studied separately, it is only when they are living together that nitrogen fixation occurs as a result of their interactions. One would never know that bees or locusts form swarms under certain circumstances from studying individuals rather than the behavior of populations. The near absence of

holistic thinking in Western science—considering the whole system and examining the interactions occurring within it—continues to be responsible for the slow progress in many branches of science. Although lip service is given to the importance of holistic thinking, in most fields, and with few exceptions, researchers study isolated phenomena, disregarding the interactions among organisms and between organisms and their chemical and physical surroundings.

In recent earth history, the activities of animals and plants, along with geophysical and chemical weathering processes, have helped to maintain relatively stable atmospheric, oceanic, and soil oxygen and carbon dioxide concentrations. That is until human activities of the last century occurred, especially during the Great Acceleration.

Food Webs

Green plants are the source of energy for almost all other organisms.[9] These primary producers use the energy of sunlight to drive photosynthesis, a process in which they incorporate carbon dioxide from the atmosphere to produce energy-rich molecules that are then used to carry out essential metabolic processes.

Virtually all organisms unable to photosynthesize use solar energy that is first captured by plants. The most simplified general pattern is a connection of organisms arranged in a network, or web, dependent on one another for survival. It is, of course, much more complicated and extensive than this. Nutrients and energy are transferred from one organism to another, with some of the energy dissipated as organisms use it for their growth, development, and reproduction.

The interactions result in food webs, in which the waste matter of one organism, or the organism itself, becomes the food source for another in the web of life. For example, many soil fungi feed on the remains of plants (primary producers), later becoming a nutrition source for nematodes that can then be eaten by an arthropod such as a beetle (see Figure. 8.1). There is a continuous flow of energy and wastes between organisms and other parts of the environment.

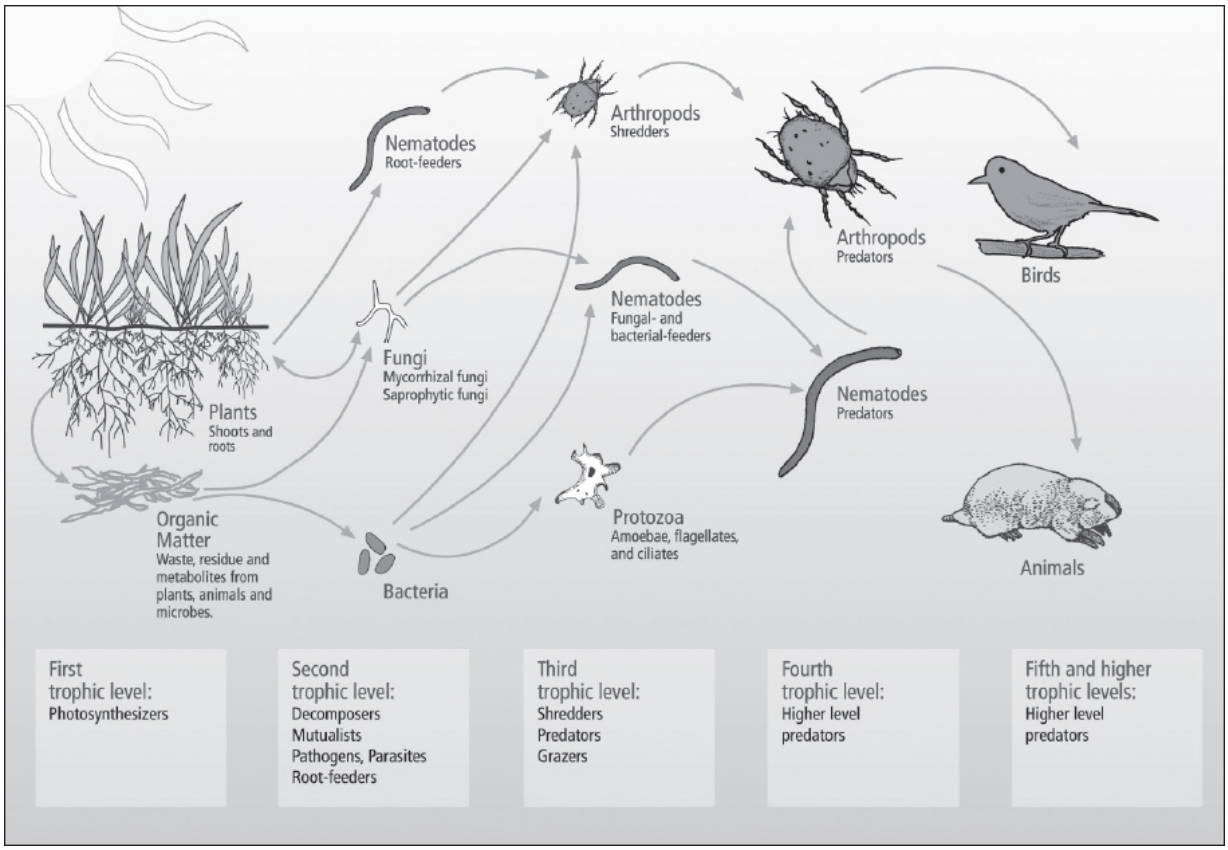
The energy from the sun that is incorporated into plants is transferred to organisms in the second tropic level (the first consumers), then to the third tropic level (that feed off the first consumers), and so on. It is common to refer to organisms higher up on the food web as being at a higher tropic level. However, relationships among organisms are not hierarchical. There are organisms that feed on others, such as when a bacteria-feeding nematode uses bacteria as a food source. But when an organism that appears to be higher up the food web dies, it becomes food for those lower down, completing a cycle of nutrients.

Earlier we discussed how the workings of capitalist economies created disturbances and rifts in the natural cycles of water, nutrients and gases (see chapter 3). To grasp how we might consciously interact with the biosphere as we provide ourselves with life's needs, including healthy ecosystems, we must understand the intricate balance of nature and how natural processes and cycles functioned before such large disturbances occurred.

Organisms Participate in Global Cycles

The exchange of substances between an organism and its surroundings changes the chemical, biological, and physical conditions in its vicinity. Through their interactions with their local environments, organisms shape and reshape the environments in which they are living. Though cyanobacteria may be the species that had the largest effect at the planetary level until humans came along, other organisms are involved in important natural processes and cycles.

Figure 8.1: Soil Food Web



Source: USDA Soil Biology Primer Photo Gallery.

The Hydrologic Cycle

An estimated 60 percent of the precipitation that falls on relatively undisturbed land enters the soil and is stored there in a form that's mostly available to plants. The remaining 40 percent flows either through the soil into aquifers and springs or flows overland into streams, rivers, lakes, and wetlands. Plants need a lot of water to grow. To produce one pound of the edible portion of food plants take hundreds or even a thousand or more pounds of water.[10] About 90 percent of this water is taken up from the soil and then transported through the plant's specialized tubes to the leaves, where it evaporates from the same openings that provide entry for the CO_2 needed for photosynthesis. Thus most of the water stored in soil and taken up by plants is returned to the atmosphere—an essential part of the hydrologic cycle.[11]

The structural condition of soils—how porous they are and the number of large pores open at the surface—is critical for controlling how much water infiltrates into soil versus the quantity of surface runoff. When undisturbed by humans, soil structure is primarily a function of the living organisms in it: plants, fungi, bacteria, earthworms, beetles, and so on. In fact, soil would not even be soil without living organisms and their remains; it would simply be ground-up sterile rocks and minerals. The higher the rate of biological activity and the better the physical condition, the more that soils can accept rainfall and store it in their pores. This means that less precipitation runs off the land, which means less soil erosion, better recharge of aquifers, more even flow of rivers and streams, and more water available for plants to use. When plants are present, rain first hits the leaves, lessening the impact of the raindrops on the soil surface.

Another aspect of the interaction of living organisms and the water cycle has become appreciated only in the last decade or so.[12] There are transfers into the atmosphere of organisms, dust particles, and gaseous organic compounds given off by plants. As wind sweeps over the land and sea and waves break in the ocean, organisms, organic compounds, and particles are picked up and whisked along, eventually reaching high into the atmosphere. Almost all rainfall begins its descent into the atmosphere as ice. The compounds, organisms, and inorganic particles become the nuclei around which ice particles form. One of the researchers on the phenomena of bacteria and ice nucleation in clouds, David Sands, has commented: “We need to recognize these microbes as a part—maybe even a major part—of meteorological processes.”[13] In another example of organisms influencing precipitation, the high evaporation rates of tropical rain forests create low atmospheric pressure relative to surrounding regions. These forests “draw in moist air that converges and rises, generating annual rainfall that surpasses (typically at least double) local evaporation.”[14]

The Carbon Cycle

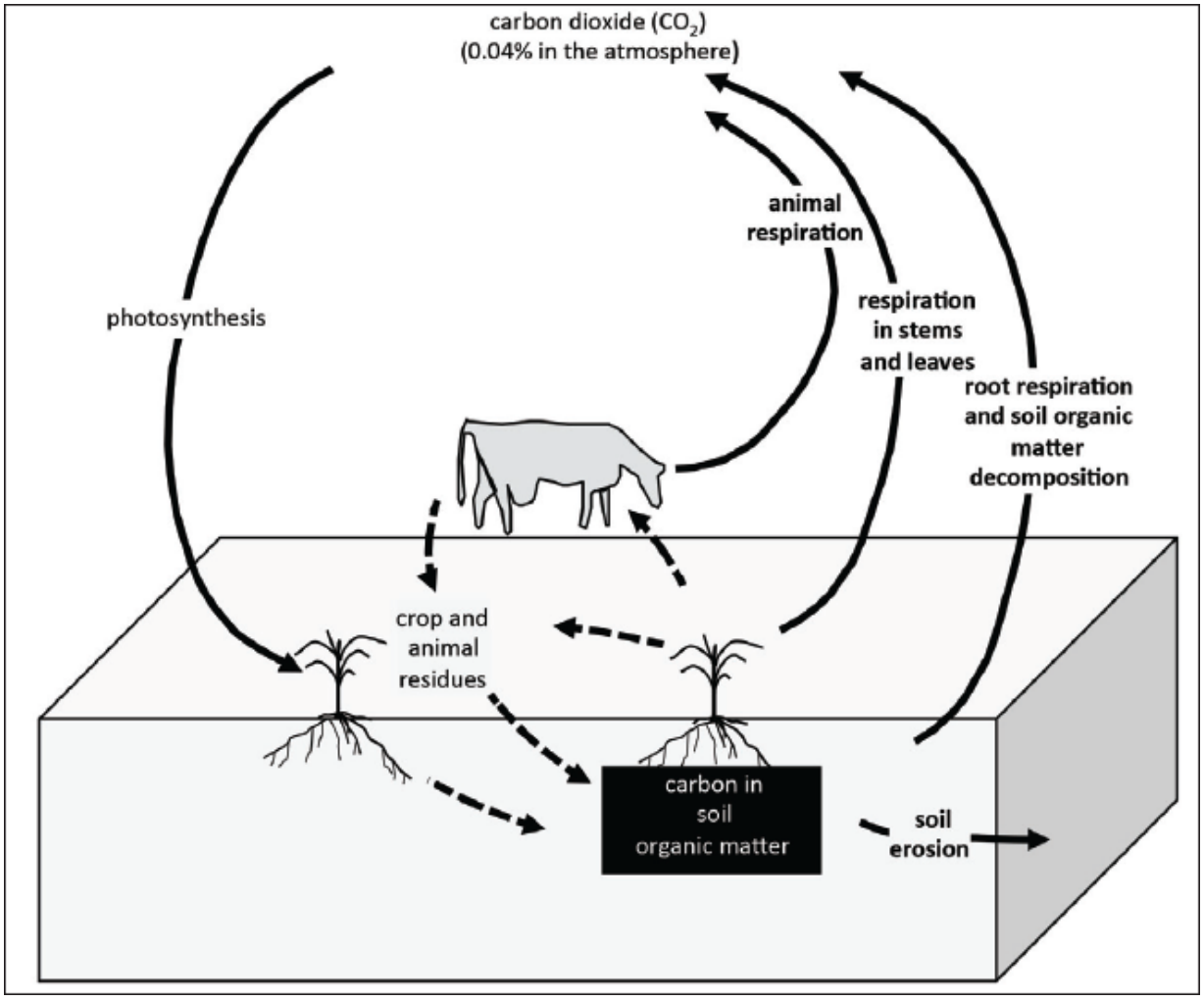
Take a breath and then slowly let it out. During this process, repeated unconsciously thousands of times each day, you are interacting with the global atmosphere. With each inhalation and exhalation you are depleting

the atmosphere ever so slightly of oxygen and enriching it ever so slightly with carbon dioxide. As the cells in our bodies work, they take in oxygen to function and emit carbon dioxide as a waste product. The exchange of gases that occurs during breathing, resulting from the process of aerobic respiration is a metabolic interaction between a human and the atmosphere.

Soils breathe as if they were single organisms. Soil-dwelling microorganisms, medium-size animals such as nematodes and rotifers, and larger organisms such as ants, earthworms, and plant roots go about everyday life processes and in doing so modify the composition of the soil. Carbon dioxide given off by these organisms enters soil pore spaces and diffuses up to the atmosphere. Simultaneously, soil organisms take up oxygen, lowering its concentration in the soil's air-filled pores, causing it to diffuse from the atmosphere into the ground. Wind and changes in atmospheric pressure assist the continual movement of oxygen and carbon dioxide into and out of soils.

The atmospheric carbon dioxide curve (see Figure 3.3, page 87), which shows steadily rising CO_2 levels since the 1950s, indicates small fluctuations during the year. In the Northern Hemisphere, where the Mauna Loa Observatory is located, when plants are less active but other organisms are using oxygen and giving off carbon dioxide, atmospheric carbon dioxide content increases slightly, reaching a peak in early spring. But the use of huge amounts of carbon dioxide in the process of photosynthesis when plants are actively growing (late spring through summer) is larger than the release of carbon dioxide by respiring organisms, leading to a small decrease of atmospheric CO_2.

Figure 8.2: Terrestrial Carbon Cycle



Note: Boldface indicates carbon losses from soil.
Source: Fred Magdoff.

A large part of the global carbon cycle occurs as plants remove CO_2 from the atmosphere during photosynthesis and the respiration of countless organisms, feeding directly or indirectly on plants, returns carbon dioxide fixed by plants to the atmosphere. But the uptake and release of CO_2 is not the only gaseous biological interaction involving carbon. For example, microorganisms in wetland soils produce methane (natural gas, or CH_4—a greenhouse gas that, pound for pound, has more than twenty times the warming effect of CO_2), with a portion reaching the atmosphere.

Nutrient Cycles

"For soil thou art, and unto soil thou shalt return." These words from Genesis 3:19 are literally true for most terrestrial organisms.[15] Out of the eighteen nutrients essential for plants to grow, all except carbon and a portion of oxygen are taken up from the soil. When animals eat plants, or eat other animals that have eaten plants, they ingest these nutrients. For example, the calcium and phosphorus dissolved in soil water is taken up by plant roots and moved together with water through specialized tubes to leaves, fruits, and seeds. Animals eat the plants, ingesting the calcium and phosphorus that is then used to build bones and manage other metabolic processes in our bodies.

When trees or grasses die, their roots, stems, and leaves decompose and nutrients are released back into the soil. Animals also facilitate a cycling of nutrients when they release waste products in the form of urine and feces not too far from where food is consumed (Figure 8.2, page 224). But a true nutrient cycle, in which nutrients return to the original point from which plants removed them, is only one type of flow. Nutrients removed from a plot of land in the form of food for use in some other location is another type of flow. Nutrient flows also occur on a global scale, as when the dust from the Sahara Desert and the Sahel region of North Africa is picked up and transported to the southeastern United States and South America. One of the ways that the Amazon forest has been able to maintain its fertility over centuries is through the large input of nutrients from the Sahel: an estimated 27 million tons of dust is transported from Africa annually, contributing some 22,000 tons of phosphorus to the Amazon basin, enough to balance losses from runoff and leaching.[16] This flow of nutrients interacts with the water cycle: years of higher than normal rainfall in the Sahel promote plant growth, and are followed by years of below-normal dust transfers to the Amazon as plants help to keep soil in place.

In chapter 3 we described a rift in the long-distance cycling of nutrients by many species of animals as a result of ruthless exploitation for profit. In earlier eras seabirds, large land and sea animals such as bison, elephants, and whales, and ocean fish that spawn in fresh water (anadromous) played vital roles in moving nutrients far away from high concentrations and distributing them around the planet, enhancing Earth's fertility and

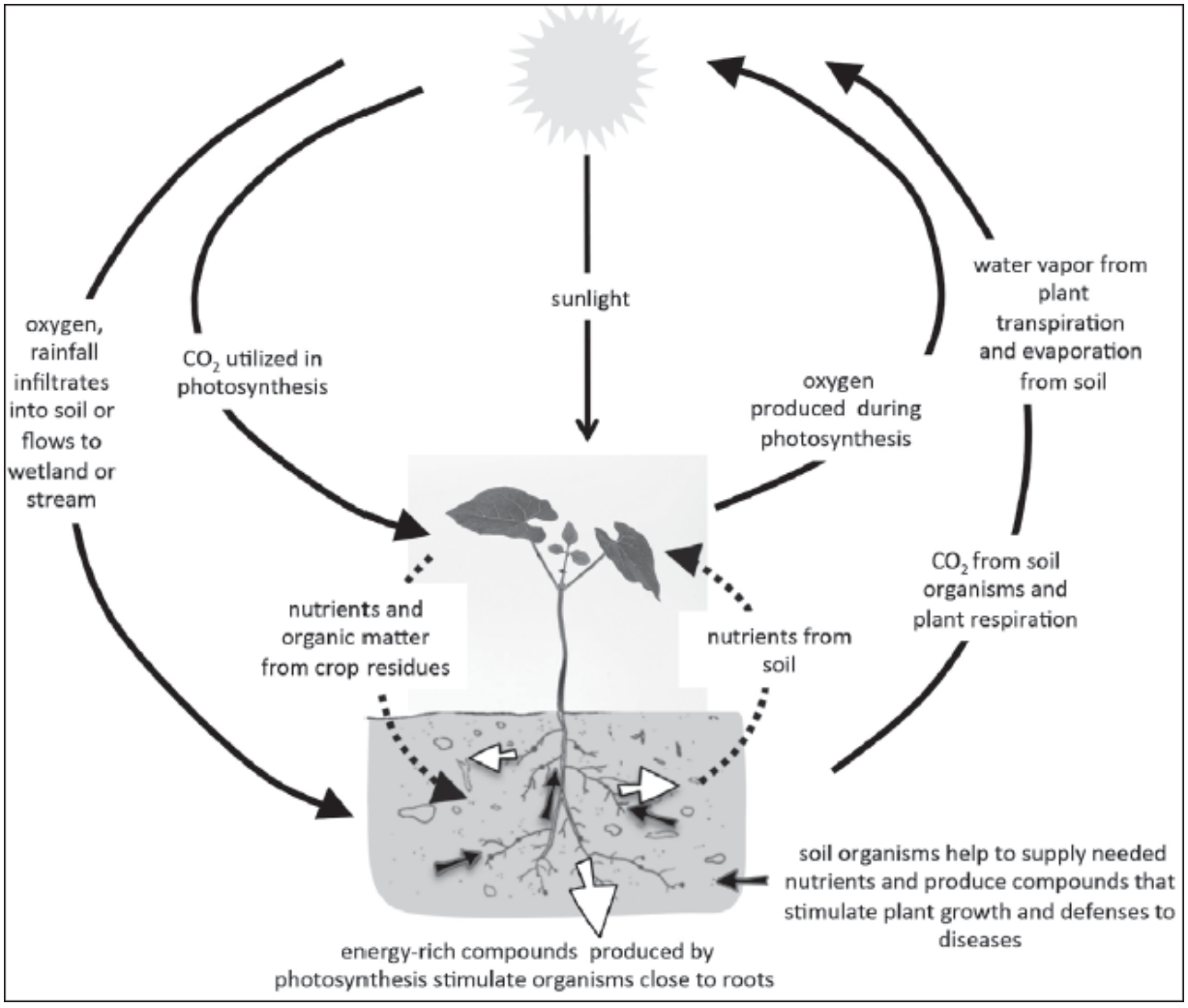
biological productivity.[17] Whales move nutrients from deep in the ocean to surface waters, anadromous fish and seabirds move them from the ocean to the land, and migrating herds of herbivores distribute nutrients over long terrestrial distances.

The global nitrogen cycle is also of critical importance. Nitrogen is an essential nutrient for plants and animals, mainly because it is a component of proteins, but plants and animals are not able to utilize the main form in which it exists in the atmosphere, as nitrogen gas (N_2), representing 78 percent of the atmosphere. Plants obtain nitrogen in a number of ways; the primary sources derive from microorganism—living either free in the soil or within plant roots (in legumes, for example). These organisms are able to convert nitrogen gas into a form that plants can use. (The industrial process used to make nitrogen fertilizer requires very high temperatures and pressures and lots of energy (fossil fuels).) Microorganisms also produce N_2 and N_2O—nitrous oxide, also a greenhouse gas and hundreds of times more potent than CO_2—when plentiful levels of nitrate are present and soils are wet. This depletes the soil of nitrogen in forms that plants utilize.

Plants Interact With Other Organisms

Plants are in a dynamic interrelationship with various organisms and the chemical and physical environment in soil and atmosphere (Figure 8.3). In addition to participating in global cycles, plants sense their environment and respond to ensure better nutrition, growth, and protection against diseases and insects. Plants have such sweeping effects that “soil undergoes great and lasting evolutionary changes as a direct consequence of the activity of the plants growing in it, and these changes in turn feed back on the organisms’ conditions of existence.”[18]

Figure 8.3: Plant Interactions with Soil and Atmosphere


sunlight
oxygen, rainfall infiltrates into soil or flows to wetland or stream
CO_2 utilized in photosynthesis
oxygen produced during photosynthesis
water vapor from plant transpiration and evaporation from soil
CO_2 from soil organisms and plant respiration
nutrients and organic matter from crop residues
nutrients from soil
soil organisms help to supply needed nutrients and produce compounds that stimulate plant growth and defenses to diseases
energy-rich compounds produced by photosynthesis stimulate organisms close to roots

Source: Modified from Fred Magdoff, "Creating an Ecological Civilization," *Monthly Review* 62(8):1–25 (January 2011).

As with the forest trees mentioned earlier, most plants grown for food form mutually beneficial associations with mycorrhizae fungi.[19] The fungus, a different type of mycorrhizae than found with trees, grows partially inside the plant root. It also sends out root-like hyphae into the nearby soil, essentially enlarging the plant's root system. The fungus receives sugars produced by photosynthesis and provides the plant with many benefits: by exploring more of the soil than roots can do alone it has access to greater quantities of nitrogen, phosphorus, and water. The fungus also helps to make phosphorus in the soil more soluble and available for uptake. If those

advantages aren't enough, the presence of mycorrhizae lessens the ability of disease organisms to attack roots.

Plants continually produce defense compounds such as nicotine and tannic acid that offer protection from attack by bacteria, fungi, and viruses and ramp up production in response to infection. Some of the chemicals in fruits and vegetables that help to ward off diseases and insects induce mild stress in humans, which is believed to account for their health benefits, possibly including protection against brain disorders such as Parkinson's and Alzheimer's.[20]

Bees, other insects, and bats pollinate many plants, and a variety of mammals and birds eat the fruit of plants and disperse their seeds. Approximately 95 percent of Brazilian rain forest trees depend upon animals to spread seeds. Aquatic ecosystems are similarly intertwined and interactive; phytoplankton in the oceans absorb as much carbon dioxide as terrestrial plants, provide sustenance for other marine organisms, and sequester a portion of carbon in the deep ocean sediments when they die.

Animal and Microbe Interactions

When we discuss microbes, the first examples that might come to mind are probably harmful disease-causing organisms. Though there are numerous microbial diseases, there is a whole other dimension to animal–microbe interactions. As Ed Yong, staff science writer at *The Atlantic*, points out, most microbes do not make us sick: "At worst, they are passengers or hitchhikers. At best, they are invaluable parts of our bodies: not takers of life but its guardians. They help to digest our food, educate our immune systems, protect us from disease, sculpt our organs, guide our behaviour, and maintain our health."[21]

Scientists have begun to appreciate the importance of these organisms, their large range in types, and the effects they have on people.[22] It is estimated that over 10,000 species of microorganisms are living in cooperative association with healthy humans, with total populations in the trillions of organisms per person. They are inside our mouths and digestive systems and on our skin. This human microbiome allows us to digest food and protects us as we provide these organisms a safe environment and

sustenance. It is estimated that these organisms comprise about half the cells in our bodies.[23]

Human microbiomes co-evolved with our species and contribute to the normal functioning of the body:

> A burgeoning body of research suggests that the makeup of this complex microbial ecosystem is closely linked with our immune function. Some researchers now suspect that, aside from protecting us from infection, one of the immune system's jobs is to cultivate, or "farm," the friendly microbes that we rely on to keep us healthy. This "farming" goes both ways, though. Our resident microbes seem to control aspects of our immune function in a way that suggests they are farming us, too.[24]

The diversity of the human microbiome is diminished in rich countries through the overuse of antibiotics, sanitized living quarters, and the routine use of antimicrobial soaps.[25] Children often cannot or aren't allowed to play outdoors in contact with grass and soil. These living conditions, with reduced microbial exposure, can have detrimental health effects. The increase of certain ailments in developed countries may be caused by the imbalance and reduced diversity of gut bacteria.[26] There is much more to be learned in this area, and studying organism interactions may provide breakthroughs in human health and ecological understanding.

Intentional Human Interaction with the Biosphere

Humans have developed a way of living and interacting with the environment that involves, in the terminology of Canadian ecologist C. S. Holling, three unique aspects: foresight and intentionality, communication, and technology.[27] Human activities are generally intentional and can be thought through ahead of time, allowing the consideration of outcomes of individual actions. When results are not ecologically or socially satisfactory, alternative strategies and techniques can be used to modify activities (assuming they don't conflict with the interests of those in charge of the economy). Or as Frederick Engels wrote, "We have the advantage over all

other creatures of being able to learn [nature's] laws and apply them correctly."[28]

Although communication is a general characteristic of all organisms, from bacteria to land plants to animals, humans have a unique ability to communicate ideas and experiences and our technology can spread information around the globe in milliseconds. Other technologies that humans have developed—from the use of fire to control of vegetation, to gigantic mining equipment, to electric generating plants spewing pollutants—have given us the ability to greatly influence large areas of Earth, well beyond the local or temporary effects that most organisms exert. However, as biologist Stephen Mulkey has written:

> Presently human-caused climate change is an amplifier, rather than a primary driver, of human impacts on ecosystems. Toward the middle of this century, climate change will inexorably become the dominant cause of ecological restructuring of the biosphere, causing species displacements and local, regional, and global extinctions…. The double whammy of human overexploitation and accelerating climate change, if unchecked, will result in progressive ecological disruption on a scale not seen on Earth since the K-T Extinction 66 million years ago when catastrophic geologic events were the agents of wholesale disruptions of all of our planet's systems. There is no other analog in the recent geological record that compares to the speed and comprehensive nature of the transformation unfolding during this century and beyond.[29]

While nature tends to operate in a circular fashion, capitalist economies operate linearly—extracted resources are refined and manufactured into products that are shipped and used elsewhere and eventually discarded, with waste produced at each step of the process. Although the idea of a circular economy has begun to generate a lot of interest because of the depredations of capitalism, we will need a different social-economic system to actually operate a more circular economy—one in which the decision-making processes incorporate the wisdom of all people working together to maintain ecological health and integrity.[30]

In the following chapter we discuss important aspects of resilient systems, what they are like socially and ecologically, and ways to think about creating them. This means learning from nature and four billion years of evolutionary experiments.

9

Developing Resilient Social-Ecological Systems

> A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise.
>
> —ALDO LEOPOLD[1]

EARTH IS AN INTERCONNECTED WHOLE—or, more simply put by Barry Commoner, the renowned environmental activist and socialist, everything is connected to everything else. Data from satellites is confirming Commoner's words and shedding new light on the ways in which life, land, oceans, atmosphere, the moon, and the star at the center of our solar system make up one interacting, dynamic system. The discipline of Earth systems analysis takes this approach, with researchers increasingly recognizing that physical phenomena can only be truly understood through their interactions and processes, that is, as an integrated system.

However, most scientists remain trapped in partial solutions because their comprehension of the biosphere is not yet fully integrated and combined with a critical analysis of social systems, like Barry Commoner's was in the 1970s. We still need to apply the understandings about the connectivity of natural processes and cycles of the biosphere discussed in chapter 8 to the social-ecological project of creating an equitable and sustainable human society.

Unless a true tipping point is reached, the numerous ecological and social disturbances and degradations described in chapters 3 and 4 can be healed, and attempts must be made to limit and avoid them in the future. This requires a methodology for making economic decisions that recognizes

the need to create resilient people, human economies, and ecosystems. We need to make decisions that take into account possible effects over the very long term. As Marx wrote in *Capital*, "Even an entire society, a nation, or all simultaneously existing societies taken together, are not the owners of the Earth. They are simply its possessors, its beneficiaries, and have to bequeath it in an improved state to succeeding generations."[2]

Many pre-capitalist societies believe that Earth has a vital force that derives not just from plants and animals but from the land, the water, the sky (see pages 169–170). Millions of people around the world have been inspired by this conception of a vital biosphere, a constantly interacting whole across space and time. It provides a perspective in sharp contrast to the stark lifelessness of capitalist ideology and our part as mere cogs in the machine. This holistic view of the Earth can be combined and integrated with the latest science to promote new ethics toward the environment and sound practices for our interactions with each other and with the entire biosphere.

Resilience and Regeneration

Any ecosystem can be degraded if it is affected by a huge shock or repeatedly subjected to moderate ones. But some ecosystems tend to be more stable and better able to resist extreme weather events, insects, disease, or harmful human activity. Ecosystems that go through periodic low to moderate disturbances become accustomed to these disruptions and develop ways to recuperate. They resist damage to their composition and functioning because of weather or long-lasting climate anomalies or other disturbances, and are able to recover quickly from most disruptions. This is the essence of resilience, a concept of importance to humans individually and collectively, as well as to watersheds, forests, deserts, agricultural fields, or grasslands. Resiliency is a measure of sustainability over the long term.

Conditions within a biome—a large geographic region with similar climate, vegetation, and animals—are in a continual state of flux as weather goes through its seasonal changes or varies within seasons, and as

organisms live and reproduce, sometimes causing dramatic changes as they go about their activities.

Beavers provide an example of change over time within a biome. One of the essential life activities of beavers in North America is the damming of streams to provide ponds for protecting their dens. This turns a free-flowing network of streams into a series of lakes and ponds that provide habitat for fish, later becoming swampy marsh and, eventually, a soil with better drainage, suitable for the growth of forest.

Some ecosystems, or biomes, evolve because of long-term changes in weather patterns. Ten thousand years ago the world's largest hot desert, the Sahara, began to receive significant rainfall, and what had been a desert became a lush savanna, with grassland interspersed with trees. Five thousand years later rainfall began to decrease again and eventually the region returned to its current arid state.[3]

Although small and frequent disturbances promote stability in most ecosystems, some have adapted to infrequent but periodic extreme events, and some species have even evolved to require disturbances in order to propagate themselves. The giant sequoia, the largest and one of the longest living individual life-forms on the planet, requires periodic fires to kill off less fire-resistant species, to dry out their cones so that the small seeds can be released, and to provide suitable forest floor conditions for seed germination.

There is no guiding purpose to an ecosystem, nor is there an inherent bias toward stability and equilibrium. However, there are certain characteristics of ecosystems that tend to make them relatively stable over many years, even centuries. When we construct buildings in cities or produce food on farms, reasonably stable local ecosystems and intimate knowledge of them are an advantage. They allow us to better plan for the future and be more confident that what actually happens is what we hoped would occur.

Resilience and sustainability have become buzzwords, almost universally embraced, which threatens to make them meaningless. After all, who would want to be unsustainable or lack resilience or have an unsustainable business? Companies, governments, and even the U.S. military regularly bandy about these terms. An article from Maxwell Air Force Base is titled "Airmen Learn to 'Bounce Back' at Resiliency

Training."[4] In 2012 Donald Trump put into words the way that many feel about the concept: "Resilience is part of the survival of the fittest formula—make sure you remain adaptable."[5] Those on the resiliency and sustainability bandwagons use the terms to promote adaptation to social-ecological crises, avoiding consideration of potential political and economic causes. However, the basic concepts of resiliency and sustainability are extremely important when we consider people, societies, and ecosystems.

Animals, plants, and entire ecosystems lose resistance to adverse conditions and become less resilient when they experience severe stress. An ecosystem can be stressed by extreme weather events and fire or by removal of a keystone species—one that plays a singularly decisive role in the ecosystem. For example, when a synthetic chemical in India poisoned vultures, they no longer recycled the flesh of dead animals. With so much extra food, there was a large increase in the feral dog population and an increased incidence of human deaths because of rabies. Africa's vultures are disappearing at a rapid rate, with six of the eleven species on the continent in danger of extinction. As in India, the disappearance of African vultures is a health risk to humans and farm animals "since populations of other scavengers such as rats and jackals could rise as a result."[6]

When coastal mangroves are removed for such purposes as shrimp farming, roads, and tourist facilities, land nearby is no longer protected from the effects of sea level rise, salinization of groundwater and soil, and extremely high seas caused by tsunamis, cyclones, or other strong storm surges. It is estimated that over half of the world's mangrove forests have been lost, increasing the vulnerability of all those exposed areas of the coast.

As with ecosystems, individual organisms can be more or less resilient in the face of challenges. When plants are stressed by growing in compacted soils or suffer rainfall extremes they become more susceptible to insect attack and root diseases. When humans are stressed by loss of employment or other adverse occurrences such as persistent poverty and discrimination, they are less resistant to illness, less able to bounce back from adverse conditions, and more likely to die at a younger age.

Just as with the human microbiome, balanced soil microorganism-plant-animal interactions capable of continual regeneration of functions are critical to maintaining stable and resilient ecosystems. This diverse

population of soil organisms provides the nutrients and compounds that help plants grow and defend themselves against pests, allows only low populations of organisms that attack plants, and helps maintain a soil structure that enhances infiltration of rainfall and storage capacity for water. The interactions of the great diversity of soil organisms are essential for regulating the numbers of each individual species present, keeping biological balance, and sustaining the functioning of the whole system.

Learning from Nature

In the nineteenth century Frederick Engels emphasized the need to align our thinking with the laws of nature. He wrote:

> Freedom does not consist in any dreamt-of independence from natural laws, but in the knowledge of these laws, and in the possibility this gives of systematically making them work towards definite ends. This holds good in relation both to the laws of external nature and to those which govern the bodily and mental existence of men themselves—two classes of laws which we can separate from each other at most only in thought but not in reality.[7]

However, in the capitalist society in which Engels lived, business owners sought instead to learn how to *overcome* or *circumvent* the ways nature worked in order to exploit resources. There was no concern for negative short-term or long-term effects—a phenomenon Engels decried with great passion.

The scientific understanding in industrial societies of nature's laws, especially the complex interactions occurring within ecosystems and how to apply them to human endeavors, has only recently come into its own with developments in fields such as agroecology, ecological design, and most recently, biomimicry. Although there is overlap among them, the common denominator of these different fields is a commitment to providing human needs by using methods based on those of individual organisms or stable and resilient ecosystems and, when practical, by integrating these endeavors with an understanding of the processes of the surrounding living organisms. After all, over billions of years of evolution, life has come up with many

elegant solutions to problems that vastly different organisms have encountered.

As with all living creatures, when humans interact with the rest of the biological world and other facets of the biosphere, we change the ecology of the land, rivers, forests, and oceans. However, it is possible to *manage* the areas we disturb in ways that minimize the negative impacts on the functioning of the ecosystem. A combination of sustainable practices makes this possible, through applications of local knowledge, the findings of science using whole-system approaches, understandings about how individual practices fit well together, and studying the ways that evolutionary processes have generated organisms and ecosystems adapted to a wide range of conditions. As we interact with the rest of the natural world, it is essential to keep an open mind and to reevaluate ongoing practices, with the benefit of experience and advances in scientific knowledge and technology, in order to ensure that the ecosystem is functioning in ways that promote long-term sustainability and human health.

Biomimicry

Biomimicry is an approach to working with and learning from nature by studying how organisms have overcome issues similar to ones we confront, and applying that knowledge to solve human social and technical issues in a more ecological and holistic manner. For example, Scott Turner, a professor of animal physiology at the SUNY College of Environmental Science and Forestry in Syracuse, studies tall termite mounds in Africa as an example of adaptive structures. The mounds don’t actually have any residences, they are structures built specifically to maintain throughput of oxygen in and waste gases out by having enough thermal mass and ventilation to bring in sufficient fresh air to replace air inside the mound:

> Functionally, these mounds are devices for capturing wind energy to power active ventilation of the nest. They are *adaptive structures*, continually molded by the termites to maintain the nest atmosphere.

> This ability confers on the colony … the regulation of the nest environment by the collective activities of the inhabitants.[8]

This example of the termites inspired the design and building of the Eastgate Center for offices and shopping in Harare, Zimbabwe; the design has greatly reduced energy use for ventilation and cooling and did not require installation of an air-conditioning system.[9] Other examples of using nature's design in human activities include the invention of Velcro, based on the attaching and holding power of burrs; the modification of wind turbines based on the surface characteristics of whales' tails; and, most famously, the design of an airplane wing that mimics that of birds. As biologist Janine Benyus writes in *Biomimicry*, by using this approach

> we would manufacture the way animals and plants do, using sun and simple compounds to produce totally biodegradeable fibers, ceramics, plastics and chemicals. Our farms, modeled on prairies, would be self-fertilizing and pest-resistant. To find new drugs or crops, we would consult animals and insects that have used plants for millions of years to keep themselves healthy and nourished. Even computing would take its cue from nature, with software that "evolves" solutions, and hardware that uses the lock-and-key paradigm to compute by touch.[10]

Studies of biological systems in order to learn from them and adapt solutions developed over evolutionary time to our interactions with and use of materials is at an early stage. There is much to be learned continuing down this course.

Stable, Resilient Ecosystems: Implications for Human Society

A number of characteristics support stable natural ecosystems, allowing them to resist degradation and be resilient in the face of challenges. These can be considered and evaluated when managing ecosystems for agricultural or other purposes and can be investigated as to their suitability and usefulness for human societies.

Using Local Resources

As we discussed in chapter 8, ecosystems are not closed off, any particular area of forest or grassland may interact with other regions or even biomes, sometimes at extremely long distances.

However, examination of the characteristics of many terrestrial ecosystems with limited human damage—species-rich or species-poor, highly productive or not, easily disturbed or resistant to disturbance—indicates that all exist by relying primarily on locally available resources: sunlight, rainfall (and climate in general), the soil and its organisms, and the plants and animals living on the land.

To the extent that it is reasonable and avoids duplication or waste of resources, there is an analogy to the workings of ecosystems for human society: each community, town, city, region, and multiregional area should emphasize using locally available resources to provide the goods and services needed by all their inhabitants. Although this is a general concept, with the details to be worked out during the process of change to a new society and economy, the point is that what can logically be done locally should be—from growing some of the basic foods to feed the local population, to being able to install and repair domestic water and electricity systems, to generating electricity, to having access to educational and recreational opportunities, medical care, and so on. (See “Location of Production” in chapter 11 for further discussion of this issue.)

This is a very different notion than the one advanced by the contemporary localist movement that stresses the importance of stimulating local economic activity. In a capitalist society, in which so much money leaves the local area to be funneled to large corporations hundreds or thousands of miles away, a primary goal of the localist movement is to help provide jobs by keeping more money circulating locally. But the real problem is not things and where and by whom things are produced and in what kind of store they are sold; it is the relations between the things in question and people. In an ecological society, there can be no problem of insufficient jobs: if less labor is required to produce what we need, workers will just work fewer hours. If the goal of society is to maximize equal access to resources needed for a high quality of life while minimizing negative environmental effects over the long term, then the questions

become: Which industrial production processes and types of agriculture should be used? Where should they occur? How should goods be moved? How should goods be distributed?

Strength in Diversity

A diversity of organisms characterizes many stable, relatively undisturbed ecosystems in temperate and tropical regions. But diversity is important not only because of the number of different species. Because some organisms carry out the same or similar functions, the extent of *functional* diversity (organisms performing different types of tasks) influences how an ecosystem performs. And though the presence of many species carrying out different functions is important, the relative abundance of organisms also determines the level of stability and resilience. The rich metabolic connections between so many species provide biological synergies and nutrient availability and reduce the possibility that a single causal factor will undermine the whole ecosystem.

A similar principle applies to human societies. A diverse array of human contributions, skills, and knowledge—what is referred to as functional diversity—confers a strength and resiliency on society. It contributes to the vibrancy of the social, cultural, and economic life of communities. Societal diversity can also occur as communities experiment and find a variety of different ways to organize, communicate, and solve particular problems—as long as all are dedicated to the goals of equity and ecological stability. Multiplicity in opportunities for work, education, recreation, and the development of one's own interests will characterize stable and resilient communities—communities that evolve and change over time.[11]

Self-Regulating Systems

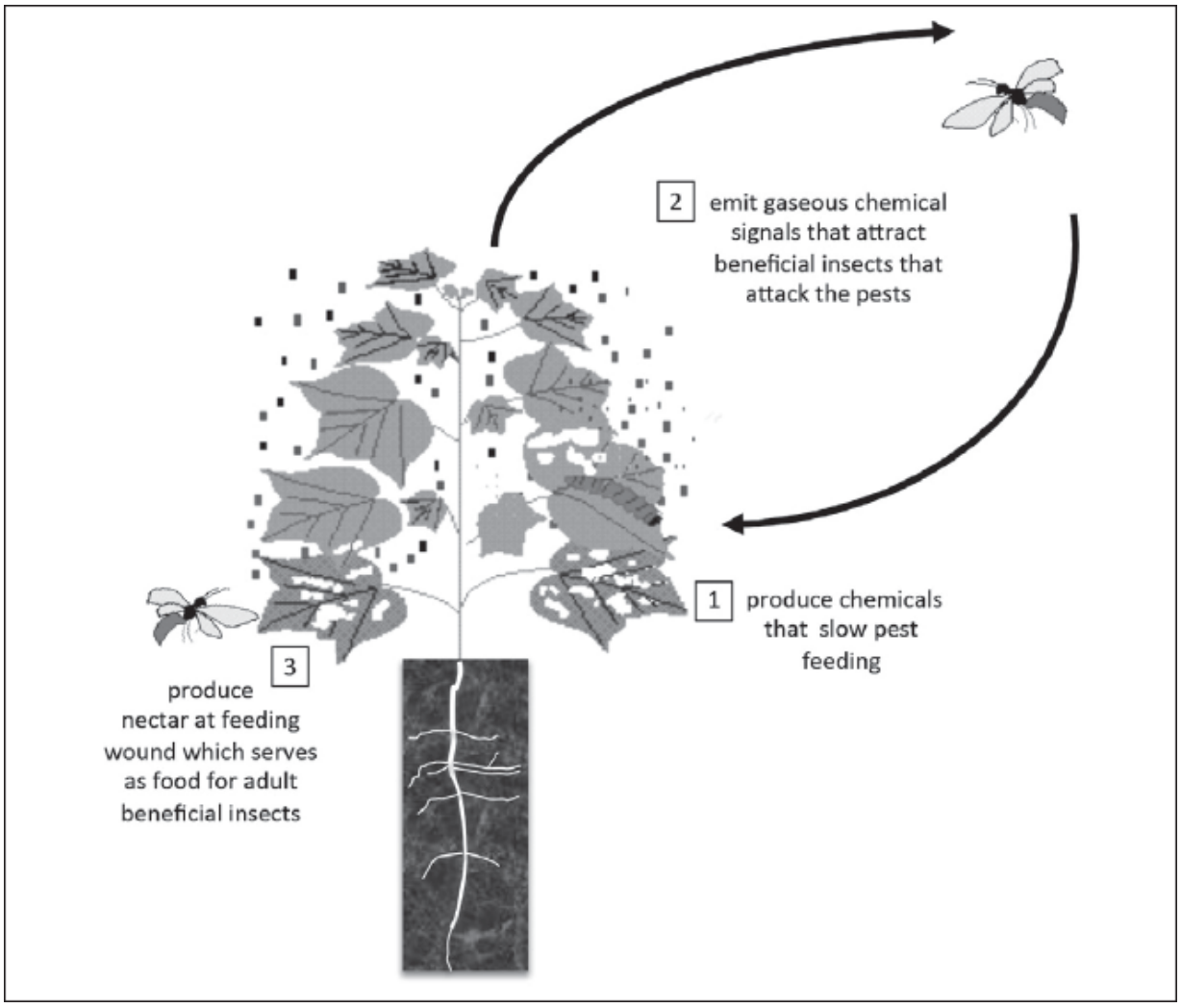
High levels of biological diversity tend to produce so many interactions and multiple pathways among organisms that outbreaks of diseases and parasites or overabundance of herbivores or predators, in concentrations large enough to compromise the integrity of the ecosystem, are uncommon.

With so many different species competing and cooperating for resources and living off one another in various ways, populations stay in relative balance over the short and medium term. Populations of individual species on land and in the soil, oceans, and rivers will naturally vary with the time of day, the time of year, the amount and frequency of rainfall, and so forth. But a high degree of functional activity is usually maintained. The efficient cycling of inorganic nutrients through biological processes is a type of regulation that makes large and constant additions of nutrients normally unnecessary to maintain fully functioning non-managed ecosystems.

Examples of regulation that enhance survival include the many systems animals have to defend themselves when under attack by other organisms. But plants also have a number of defense mechanisms that help protect them from attack by fungi and bacteria. There are also beneficial insects that prey on (or lay their eggs in) other insects that feed on plants. Plants being eaten by herbivores produce chemicals that slow insect feeding, produce substances that can be used by beneficial organisms, and send out chemical signals that recruit the specific organism to attack the particular herbivore (see Figure 9.1).[12]

Even more awe-inspiring is the biological control of an insect that feeds on tomato plants, the hornworm caterpillar. The small parasitic wasp that lays its eggs in the caterpillar—after having been enticed by the gaseous chemicals released by the plant—simultaneously injects a virus that deactivates the immune system of the caterpillar.[13] This allows the eggs to develop inside the caterpillar, eventually killing it. Without the virus from the wasp, the caterpillar’s immune system is able to destroy the wasp’s eggs —an astonishing example of interactions among species brought about by their co-evolution.

Figure 9.1: Plants Use a Number of Defense Strategies Following Damage by Feeding Insects.


2 emit gaseous chemical signals that attract beneficial insects that attack the pests
1 produce chemicals that slow pest feeding
3 produce nectar at feeding wound which serves as food for adult beneficial insects

Source: Modified from unpublished slide of W. J. Lewis.

A particular beetle that feeds on plants may encounter numerous other competing or antagonistic species that keep its population from getting too high. For instance, the Colorado potato beetle can be attacked “by a variety of predatory bugs and beetles in the foliage of the plants, and pathogenic nematodes and fungi that inhabit the soil.”[14] This means that human management—in the examples of the beetle and the hornworm caterpillar, by farmers in agricultural ecosystems—must have the development and maintenance of a rich diversity of species as an important overall strategy to limit outbreaks of pests.

An interesting illustration of self-regulating behavior in the wild that seemingly replicates, in an unconscious way, the democratic decision making of humans, occurs when the number of bees in a hive grows too large:

> Bees swarm to a temporary location. Scouts go out in different directions and then report back by performing a dance that provides information about the location scouted and its conditions. Other bees congregate around the original scout they think has selected the best site. When enough bees agree on one of the locations, the entire swarm then goes off to build a hive there. When a large enough number of bees agree about a site, they end up selecting the best one.[15]

There are similar examples in other species. For example, European bison, when deciding which direction to move after exhausting local feed, "operate by majority rule."[16]

Self-regulation in human society corresponds to profound democracy, beginning at the productive base of society, in which all voices participate and make decisions on group needs to provide everyone with the essentials of a good and fulfilling life. At the society-wide level, it implies democratically decided regulation of interactions with fellow humans and the rest of the natural world. This means conscious and well-thought-out management and use of resources to supply human needs so that the maintenance of healthy environmental functions and succeeding generations are accounted for. When provided with the necessary information, groups of people tend to make better decisions than individuals making decisions for the group. And when people are meaningfully involved in the decision-making process, they feel more personal involvement and more desire to help implement group decisions.

Balanced Natural Cycles

Balanced natural cycles occur as a result of closely linked biological interactions, associations, and synergies. Terrestrial ecosystems with healthy soils and diverse plant species tend to be efficient in mobilizing and

cycling nutrients and in capturing, using, and storing rainfall, particularly in more arid areas and during dry spells in humid regions. Ecosystems are maintained by their efficient pattern of consumption, production, and cycling of nutrients, continuous flow of stored solar energy and material, and ability to accept and store plentiful rainwater, averting downward spirals resulting from excessive loss of energy, nutrients, and topsoil.

In human economies and societies there is much to be learned by studying ecosystems, efficiently cycling nutrients taken up by agricultural plants and maintaining healthy forests and healthy agricultural soils. Examples of ways to enhance nutrient cycling and infiltration of rainfall (instead of allowing it to run off) on farms and in cities will be discussed in chapter 10.

Self-Renewal Following Disturbances

Ecosystems that are more stable are more resistant to disturbances; less damage is done, and they are able to bounce back more quickly. Such resiliency is a key characteristic of stable ecosystems, with other characteristics contributing to self-renewal. A seed naturally stored in the soil that germinates after a fire is an example of the self-renewal of plants. A nearby habitat with the same species as in an area that has been disturbed and lost biodiversity will allow more rapid reintroduction of plant and animal species into the habitat suffering the disturbance.

The contrast between more and less resilient agricultural ecosystems was strikingly observed after Hurricane Mitch tore into Central America in 1998. The U.S. Climate Data Center described the storm as follows:

> In an awesome display of power and destruction, Hurricane Mitch will be remembered as the most deadly hurricane to strike the Western Hemisphere in the last two centuries. Not since the Great Hurricane of 1780, which killed approximately 22,000 people in the eastern Caribbean, was there a more deadly hurricane. Mitch struck Central America with such viciousness that it was nearly a week before the magnitude of the disaster began to reach the outside world.[17]

A participatory study during the following year—involving farmers, NGOs, and scientists—examined the damage and recovery of agricultural areas in Nicaragua and found that “on average, agroecological plots on sustainable farms had more topsoil, higher field moisture, more vegetation, less erosion and lower economic losses after the hurricane than control plots on conventional farms.”[18]

What we need to do is to combine the eradication of poverty and inadequate access to resources that led to so much human tragedy with agroecological practices. If societies plan well for possible infrequent occurrences such as earthquakes and hurricanes, people shouldn’t die during predictable natural disasters. And ecosystems, including human-dominated ones, should be able to recover quickly from periodic large disturbances and extreme weather events.

Community, regional, and intercontinental social structures and economies that embrace and enhance diversity of backgrounds and ideas, and exhibit democratic communal regulation and balanced social-ecological cycles, will better withstand adverse events and regenerate all their functions more quickly following such events. An entire human society built on principles of solidarity, reciprocity, and cooperation across geographic regions will immeasurably enhance resiliency.

Designing Resilient Human Communities

Design of resilient human infrastructure and living and work environments can benefit from observations of how nature works and how well connected communities function. Increasing the connectivity between people in their communities as well as among other communities and regions enhances resilience. In addition, the best possible and most appropriate architecture and construction possible should be used only after objectively assessing local environmental risks, such as storm surges or earthquakes, and meshing these with local cultural knowledge and experience. Building locations will be chosen to avoid known hazardous situations, such as active flood plains or along a coast with inadequate height above sea level or protection from storm surges.

Coastal communities in some locations can be protected from storm surges by reintroduction of mangroves, wetlands, and oyster beds and integration of those with the edges of coastal cities; another is reforesting denuded slopes and changing land use so that marginal terrain does not have to be farmed. There are other obvious benefits to doing these things: increasing biodiversity, allowing people to observe wildlife from their homes and workplaces, and creating living cities that are, in a very literal sense, green.

However, all those physical changes won't be possible unless they are embedded in an economic and social structure that has eradicated poverty and values equality, cooperation, and solidarity. Communities will then be protected because decisions about land and resource use will be based on the interests and desires of the community in question and utilizing the relevant scientific and local knowledge. In addition to planning for possible disasters, multiple threads of support will exist, internally and from surrounding areas, with which to pull the community together in the event of an extreme weather event. In such a society, an earthquake, major storm, hurricane, or other natural event will be just that—something that periodically happens but that everyone in society sees as their responsibility to do something about, using all available resources.

There are also ways to increase an individual's resilience. For example, better nutrition, access to preventive medical care, and eliminating exposure to toxins will greatly aid efforts to improve human health and resilience. Frequent human contact with relatively undisturbed forests, lakes, prairies, even agricultural areas interspersed with grasslands and forested areas, helps people appreciate these ecosystems and is healthy for body and mind.

Overcoming what has been called "nature-deficit disorder," resulting from spending so much time indoors and involved with electronic gadgets, promotes a child's well-being. Just living near green spaces in a city helps improve people's health, emphasizing the importance of providing quality green spaces in and near cities and encouraging people to engage with the sights, smells, and sounds of birds, trees, streams, and rocks. Human-dominated habitats such as cities need to be redesigned so as to mesh better within cycles of nature and overcome the idea that "nature" is somewhere other than in urban landscapes.

Truly ecological systems of production and living cannot become the norm today because that would go against the logic of capitalism. A capitalist economic and social system is simply incapable of doing more than occasionally adopting ecologically sound techniques here or there in piecemeal fashion, and only if they don’t interfere with the mandate for profits and growth. However, an ecological society would open the door to a completely different logic, one that treasures fulfillment of genuine human needs while regenerating and maintaining ecosystem health. The following chapter examines some examples of alternative approaches to managing our interaction with resources used to provide our basic needs.

10

Ecological Approaches to Fulfilling Human Needs

> Good solutions exist only in proof, and are not to be expected from absentee owners or absentee experts. Problems must be solved in work and in place, with particular knowledge, fidelity, and care, by people who will suffer the consequences of their mistakes. There is no theoretical or ideal practice.
>
> —Wendell Berry[1]

The overarching goal of an ecological society is to maintain the long-term health of the biosphere while equitably providing for human needs. People will eat healthy food, live in housing in well-designed cities or rural communities, breathe clean air, drink clean water, have access to good sanitation facilities, pursue health-promoting cultural, intellectual and physical activities, and develop their full potential in whatever directions they please. To provide for these needs while minimizing environmental harm, resilient and ecologically sound processes and practices will be created and maintained—for food production, energy production, water provision and conservation, the health system, transportation, and the production and distribution of housing, clothing, furniture, appliances, and so on, as well as repurposing and recycling buildings, factories, and products at the end of their useful lives.

On a global basis and within every country, a huge amount of change is needed to provide everyone with what might be considered the basic minimum of a good life. As discussed in chapter 1, billions of people are hungry or malnourished, suffer poor or no sanitation facilities, and live on a daily income of less than $2. (Even in the richest country in the world, one

in five children suffers from food insecurity.) Hundreds of millions have no access to clean drinking water, needed medicines, or regular healthcare. Hundreds of millions of people in Asia and Africa have no access to electricity. Many more millions of people around the world die or have their health impaired because they are breathing polluted air.

At the same time, fewer billionaires than can fit in a van (8 people) own more wealth than the total owned by the poorer half of the world's people. In addition to the direct indications of human need resulting from obscene disparities in wealth and resource distribution, there is a massive degradation of soil, large animals and fish stocks are being decimated, plant pollinators are threatened, and biodiversity loss and land-use changes are undermining and threatening the stability of ecosystems and ultimately our future ability to obtain sufficient food and water.

These problems cannot be solved in societies dominated by the quest for profits, with solutions proposed that are inadequate or even counterproductive. Rationality of actions is evaluated by considering what is best for business. But what if social equality and environmental considerations become our paramount concerns? Approaches that are irrational when viewed from the point of view of a capitalist economy become perfectly rational when the primary goal is the good of the biosphere and every member of our species. Viable and ecologically sound solutions are possible only when our interactions with each other and the environment are guided by what is needed for the good of all humankind and for the stability and health of the natural world.

Our purpose in this chapter is not to provide complete solutions to all the various aspects of human interaction with the rest of the natural world. Not only is this an impossible task, but doing so runs counter to a vision of society in which everyone is involved in decision making. But there are readily available realistic approaches to dealing with critical aspects of human activity such as growing food, providing renewable energy, and renovating polluted waters. These have been developed by people experimenting with new ideas and techniques, coming up with more ecologically and socially sound possibilities that provide windows into our future. We are continually learning about the world around us, and more is known every day that will help people design and use technologies appropriate to a more ecologically sound and socially just world. But the

systematic implementation of ecological techniques and technologies that are already known could go a long way to regenerating a healthy environment while providing people's needs.

Rather than the reductionist approach commonly applied to science and society, whereby only the individual parts of complicated systems are investigated, this will be a whole-system approach. A focus on individual issues in isolation can create all sorts of problems by missing the larger view of how all the parts fit together and interact. For example, in agriculture, a reductionist approach leads to simplified agricultural ecosystems with numerous environmental problems.[2]

What if we look at farming differently? What if we first internalize environmentalist Aldo Leopold's land ethic, characterized by changing the "role of *Homo sapiens* from conqueror of the land-community to plain members and citizens of it? It implies respect for his fellow members, and also respect for the community as such."[3] Instead of thinking of the obstacles that arise when growing crops or raising animals as individual problems, what if we consider them as symptoms of an unhealthy agricultural ecosystem? We can then develop an entirely different framework for understanding farming and evaluating other social and ecological questions.

Viewed in this way, the ethics, art, and practice of farming with the objective of feeding people healthy food can be consciously considered and agricultural ecosystems can be rationally managed in ways that are more in harmony with the rest of the natural world. This is a *preventive* approach to farming and food that builds ecological and social health and resilience, as opposed to the common *reactive* approach that waits until problems develop and then tries to deal with them individually in piecemeal fashion, relying primarily on technology and the need for profit. We still need to rely on a variety of individual practices. However, the appropriate ones can be selected for specific situations and creatively combined and modified to achieve the goal of promoting farms or other systems that mimic relatively undisturbed systems that are biologically diverse, healthy, and productive.

Such a proactive approach would also characterize healthcare, whereby we would strive to prevent disease and ailments rather than relying on treating them after the fact. Preventive approaches begin by studying the underlying systemic problem and then analyzing how to modify the system

—not just an isolated individual practice or symptom—to reduce or eliminate the root causes of negative phenomena such as diabetes in humans, an insect attack on a food crop in farming, or air pollution caused by extraction, processing, and use of fossil fuels. Many of the problems that are treated as technical are in fact social. For example, African men do not have a particularly high incidence of high blood pressure, although it is a common ailment among African American men. The occurrence of high blood pressure, asthma, and other illnesses can be greatly reduced by eliminating poverty, inequality, racism, and pollution.

Hand-in-hand with preventive procedures and techniques is another critical aspect of an ecological approach to managing human interactions with the rest of the biosphere: adaptive management. This means that people need to be open to change or unanticipated conditions (including those occurring as a consequence of new practices) and adapt by changing techniques or strategies in appropriate ways—and then evaluating the results. This is not to be confused with adaptation to climate change, which is an example of a reactive approach whereby climate change is anticipated but little is done to prevent it, requiring people to "adapt."

The ideas discussed below are not exhaustive treatments of the issues. Rather, they are presented as examples to indicate that we already know a great deal about how to live in a world without planetary degradation. People directly involved—whether they are farmers, industrial and city workers, city inhabitants, engineers and scientists, and the surrounding communities—will work out the details tailored to local conditions.

Growing Food

How we grow food is one of the most fundamental ways in which humans and the rest of the planet interact.[4] In short, the objective is to manage the field and farm as a social-ecological whole, with the ultimate goal of building the strengths of resilient and productive ecosystems into the agricultural ecosystem.

Everything that a farmer or gardener does in the field should be aimed at accomplishing one or more of three general goals: creating habitat above and below ground that promotes the growth of healthy plants; acting to

pressure organisms that harm crops (pests); and enhancing the presence and populations of beneficial organisms. Many practices have multiple effects and contribute to two or even all three general goals.

Farming practices normally have effects on conditions above-ground as well as those in the soil. However, it is helpful to discuss soil and aboveground effects separately. Here are examples of practices that build some of the strengths of relatively undisturbed healthy ecosystems into the aboveground habitat of agricultural ecosystems:

- Select varieties of crops not only for yield and taste but also for resistance to local pests and adaptation to the climatic region and soil.
- Use mixed cropping instead of a single species. Mixed cropping, or polyculture, can include multistory cropping in which grains such as corn or vegetables such as carrots are interspersed with fruit trees or berry bushes,. or growing beans, corn, and squash together, the “Three Sisters” of the Iroquois and other Native American peoples. Alternately, high-growing leguminous trees planted in sufficient numbers and arrangement will have fertilizing effects when their leaves fall, reduce wind speeds, and make fields cooler, thus helping to conserve water while not interfering with production of the annual crop grown in the field.[5] Non-leguminous trees can also be grown in an agro-forestry system, producing mulch from harvested branches, wood (after trees are mature), and shade from intense sunlight. Polycropping tends to raise productivity per acre through better use of resources, lessens damage by insects and diseases, and adds organic matter and nutrients to fields.
- There are other methods that productively integrate more than one crop into agricultural fields; for example, two crops can be planted near each other—one a fast-growing species and the other one that will do most of its growing after the first crop is harvested. Another multicrop system alternates strips of grass or legume perennials with annual crops. Sometimes these strips can be feed for livestock; for example, in Africa strips of the perennial legume desmodium provide animal feed and at the same time repel corn stem borer insects. In addition, its roots emit a chemical that suppresses witchweed, a parasitic plant that can drastically reduce corn and sorghum yields.[6]

- Plant crops around the field (perimeter crops) that are more attractive to insect pests than the food crop growing in the middle of the field.
- Create field boundaries and zones within fields that are attractive to beneficial insects. This usually involves planting a mix of flowering plants to provide food sources (or alternate sources). It could be as few as one or two alyssum for every fifty lettuce plants, attracting "beneficial insects including hoverflies, whose larvae each chomp down as many as 150 aphids per day."[7]
- Routinely use cover crops to provide multiple benefits in addition to providing habitat for beneficial insects, such as addition of nitrogen and organic matter to soil, reduction of erosion and enhancement of water infiltration into the soil, retaining nutrients in soil, and much more.[8] It is possible to supply all of the nitrogen required for following crops by growing a vigorous winter legume cover crop such as crimson clover in the southern United States and hairy vetch in much of the north. In Central America, farmers use the fast-growing legume *macuna* to protect the soil and to provide nitrogen for the following food crop.

Building Soil Health and Resilience

Healthy soil is the basis of a healthy and productive agriculture. Indeed, healthy soil is nothing less than one of the physical foundations of an ecological society. Such soils have sufficient nutrients, contain low amounts of harmful chemicals, accept and hold plentiful amounts of water, have high biological diversity and activity, resist compaction, and produce healthy plants less harmed by insects, diseases, and weeds. Because organic matter has profound positive effects on essentially all soil properties, as discussed in chapter 3, it is at the heart of creating healthy soils. Many of the practices discussed below enhance organic matter management while others directly influence soil structure, erosion, or nutrient availability:

- Use rotations that are complex, involve plants of different families, and, if at all possible, include hay crops such as grass, clover, or alfalfa that grow for a number of years without the need to disturb the soil. This helps

increase soil organic matter and nitrogen, improve soil structure, and control a variety of diseases and weeds.

- Add appropriate quantities and varieties of organic materials (animal manures, composts, tree leaves, cover crops, rotation crops) on a regular basis. Supply supplemental fertility to match nutrient availability to when crops are growing rapidly, needing more nourishment.
- Keep soil covered with living vegetation or crop residues, practices that encourage water to infiltrate into the soil instead of running off the field.
- Reduce tillage that buries residues and leaves the soil bare and more susceptible to the erosive effects of rainfall, and at the same time breaks up natural soil aggregates that are critical to infiltration, storage, and drainage of precipitation.
- Use appropriate machinery that limits soil disturbance. Like everything else in a social-ecological society, agricultural machinery will need to be radically redesigned. Currently, machinery is designed with two purposes: to increase profits by reducing the amount and skill of human labor and to maximize production in minimal time. Therefore most agricultural machinery is built to take advantage of giant fields filled with the same crop. Although large fields may still be necessary to produce staples such as wheat, rice, or potatoes, they may consist of wide strips of alternating crops rather than planted with one species. Even using multiple varieties of the same species is preferable to fields of genetically uniform plants. More specialized machinery will have to be developed and evaluated for use in smaller fields and in all fields containing a variety of crops.
- In addition to planting cover crops, using rotations with perennials, and minimizing tillage, use a variety of other practices to reduce erosion: introduce terracing, grassed waterways, and strip cropping along the contour by alternating a row crop with a hay crop; use natural or planted buffers between fields and streams.
- Rely on legume crops to provide the nitrogen needs of grain and vegetable crops and efficiently cycle nutrients from farm animal manures back to the fields.
- Human sewage freed of industrial contaminants should also be used to fertilize fields near cities and towns.

These are all key strategies and practices to create healthy agricultural ecosystems using a whole-system approach to growing annual crops. Not all will be used on every farm, but they should be considered for their appropriateness. But there is another aspect to a more integrated and sustainable farming—raising farm animals as well as perennial crops in combination with annual crops. Integrating animals and crops together on small- to medium-size farms has many advantages, such as using soil-building grass and legume pastures and hay crops in a rotation to feed cows, sheep, and goats, eliminating long-distance transport of feed to animals, and using the farm animal manure for easy nutrient cycling back onto the land.

Raising Farm Animals in Integrated Systems

Raising farm animals using industrial farming practices is cruel to the animals and damaging to human health and the environment. The capitalist imperative to raise animals as quickly as possible in order to reap the highest profits results in inhumane crowding conditions for the animals, the routine use of antibiotics and growth hormones, and feeding high-energy crops such as corn to beef cows, even though they are capable of getting their entire nutritional requirements from pastures and hay.

As discussed previously, in chapter 3, factory farming also causes a rift in nutrient cycling, as nutrients contained in the crops are transported long distances from where feed crops are raised to the factory farms. The large numbers of cows, combined with how they are fed and how manure is handled, have led to significant atmospheric releases of methane (CH_4), a potent greenhouse gas. Beef and dairy cows are estimated to be responsible for about 30 percent of U.S. methane emissions from human activities (the rest coming from coal mines, landfills, natural gas and oil production facilities, and other sources).[9] There are therefore plenty of reasons that animal agriculture as practiced by factory farms has been attacked as anti-environmental, cruel, and bad for the health of farmworkers and consumers.

However, there are good reasons to raise farm animals including ruminants as part of a diversified and integrated farming system. Animal products such as eggs, milk, and meat supply high-quality protein, and they can be part of a varied and healthy diet when eaten in moderate quantities,

as they are in many parts of the world. Farm animals can and should be raised in humane ways that are also ecologically sound. This will likely mean that fewer animals will be raised, with meat becoming a much smaller part of what is now known as a Western diet, and that farm animals will be more widely dispersed over the countryside. Many synergies occur on integrated animal-crop farms, allowing better rotations with healthier crops, more flexibility in transferring nutrients around the farm, fewer crop pest problems, and improved soil health. There is a substantial ecological advantage to growing a hay crop to feed to ruminants such as cows and sheep: the practice allows for better control of annual weeds and rainfall runoff and soil erosion are reduced while infiltration of water for recharge of both surface soil and aquifers is enhanced.[10] Around the world, large areas of land are not conducive to growing crops but can be used for rotational grazing. In such cases, animals don't have to be in competition with humans for use of cropland. Pigs can utilize leftover food and crop waste for a significant portion of their diet. Controlled grazing can also help prepare land that will later be used to grow crops and help reduce future weed pressure. Pastoralism and the farming of animals in general are central parts of many cultures—and there is a lot to learn from cultures that have practiced sustainable animal husbandry on marginal land for hundreds of years.

Environmental writer and farmer Wendell Berry describes attempting to strengthen a complex system as "solving for pattern." Berry elaborates on what happens when integrated animal-crop farms take the place of industrial-type farms in which animals are raised far away from their feed:

> Perhaps it is not until health is set down as the aim that we come in sight of the third kind of solution: that which causes a ramifying series of solutions—as when meat animals are fed on the farm where the feed is raised, and where the feed is raised to be fed to the animals that are on the farm. Even so rudimentary a description implies a concern for pattern, for quality, which necessarily complicates the concern for production. The farmer has put plants and animals into a relationship of mutual dependence, and must perforce be concerned for balance or symmetry, a reciprocating connection in the pattern of the farm that is biological, not

> industrial, and that involves solutions to problems of fertility, soil husbandry, economics, sanitation—the whole complex of problems whose proper solutions add up to health: the health of the soil, of plants and animals, of farm and farmer, of farm family and farm community, all involved in the same inter-nested, interlocking pattern.[11]

There is evidence that changing to integrated animal-crop farms can have a positive effect on greenhouse gas emissions.[12] On many large-scale dairy farms, manure is stored in lagoons in which the lack of oxygen stimulates methane production. But when cows spread their manure in pastures, methane production is reduced. And when they eat high-quality feeds as is common on intensively rotated pastures, cows can more efficiently convert food into usable energy for their growth, reducing methane emissions. Although cows will always emit methane-laced burbs and flatulence, raising them in an intensively managed rotational grazing system may have minimal net greenhouse gas emission because high-quality feed lowers methane emission and carbon is sequestered with the buildup of soil organic matter.[13]

Powering Agriculture

As we turn away from fossil fuels, one of the many challenges for society will be how best to power agricultural equipment. Food can be grown without power equipment, using just human or animal power, but this is physically demanding and has very low labor productivity. Furthermore, if animals are used for plowing or other field operations, extra land must be used to grow their food. Still, reversing the capitalist imperative to replace human labor with machines to drive down costs of production will be a general goal of society. When the purpose of agriculture is to grow nutritious food in an ecologically sustainable manner, as opposed to producing commodities to be sold for profit, farming will require more people working on farms. Farmers will work in conjunction with engineers to design and build farm machinery adapted to both the land and the people

who work in partnership with it. The goal will be for the machinery to run exclusively on renewable energy instead of liquid fossil fuel or “biofuel.”

Water Conservation

Freshwater is a renewable resource. However, in a number of regions around the world, groundwater is being contaminated or used at a faster pace than it is being replenished by rainfall. As the water table falls, deeper wells are required, using more energy to pump water to the surface.

To address imbalances created by capitalist agriculture when crops are grown in regions with insufficient rainfall, society will need to grow crops in regions with more appropriate climate and soil. For example, it makes no ecological sense to grow rice or cotton in California when there is essentially no rainfall during the growing season.

There are less ecologically destructive means of enhancing water availability in dry regions than large-scale construction projects or desalination. These can vary from dispersing small depressions throughout a field to building small ponds and appropriate-size reservoirs to store rainwater for later use. The melting of mountain glaciers in the Andes and the Himalayas, which accumulate water in cold months and slowly release it in the warmer months, is creating the need for reservoirs that can serve the same purpose. Irrigation techniques to minimize water loss, such as targeted and controlled drip irrigation systems, which reduce water use by up to 90 percent, should become widespread.

Reforestation has extensive material and spiritual benefits: climate control, habitat for wildlife and humans, medicinal plants, rubber, and wood that can be harvested selectively without damaging a forest’s integrity. By slowing down water movement over the land and encouraging water to infiltrate into soil, forested areas help recharge groundwater and springs and modulate the flow of streams and rivers. The same goal of slowing down storm flow and allowing safe groundwater recharge is also an issue in urban areas.

Energy Generation and Use

Changing our energy system to one that supplies the needs of all people in environmentally sound ways is no trivial task and will take a significant period of time to implement—but it can be done if we devote sufficient resources. An essential part of an ecological approach will be to reduce wasteful energy use. This will involve moving away from reliance on personal automobiles; eliminating production and use of luxury products, the military, and advertising; reducing packaging; and putting an end to other detrimental forms of energy use. Waste is unnecessary in a society based on cooperation and need rather than on competition and profit. Building and retrofitting homes and workplaces to rely more on natural lighting, ventilation, and temperature modulation, replacing energy-inefficient goods with more efficient ones, and using educational programs and assistance to promote energy-saving behavior will all reduce the demand for energy.

Heating, cooling, and ventilation account for 40 to 45 percent of energy use in residential and commercial buildings. A concerted program of retrofitting existing housing stock and constructing new buildings to take advantage of local materials and climate conditions can radically reduce this percentage. Currently, buildings are constructed to *require* air conditioning and heating as well as extensive artificial lighting, even during daytime, yet the technology and design knowledge exist to minimize these energy needs. There are many ways in which passive design features of buildings can maintain a comfortable internal temperature and flow of fresh air.

Much of the energy currently generated is wasted in frivolous or actively detrimental ways. Though a significant amount of new energy needs will be met from freed-up capacity as a result of reductions in wasteful uses in the Global North, much more electrical generation capacity will be required in countries of the Global South. Significant investment in solar, wind, tidal, and other renewable energy sources could address this need. Discoveries and improvements are constantly occurring in the provision of renewable energy systems. Experimentation is advancing on solar (PV) roofing shingles, ways of integrating photovoltaic capacity into the sides of buildings, and even solar panels embedded in roads.[14] And in rural areas, solar energy arrays and wind turbines may go together quite well with grazing farm animals. With the rapid drop in the cost of PV

instillations (over 60 percent in eight years), solar energy is predicted to cost less than coal power within a decade, and is already cheaper than coal in parts of the world.[15]

A substantial amount of energy generated is wasted as heat and dissipated into water or the atmosphere. This means that utilizing “waste” hot water already produced rather than discharging it into the environment can lead to significant energy gains. Surplus heat produced by electricity generating stations, factories, server farms, and public transport networks can be funneled into local district energy networks to heat and cool buildings, greatly reducing waste, lowering carbon emissions and lowering fuel consumption.[16] Denmark is one of the leaders in this effort, with 63 percent of homes connected to district energy networks. An indication of how much sense such systems make is that the combined heat and power stations are 70 percent efficient at conversion into usable energy as compared to only 30 percent for conventional power plants.

Minimizing the urban heat island effect, when temperatures in the city are significantly above the nonurban surrounding region by as much as 9°F, will be one of the goals of reevaluating the ratio of concrete, trees, and green space in a city. Because cities are hotter during the day and don’t cool down as much at night, more people use air conditioning in the summer months, which has the effect of raising the outdoor temperature still further. The United States isn’t one of the hottest countries, but it uses more electricity to cool buildings than all other countries combined. New research indicates that nighttime air conditioner use in some U.S. cities can add an additional 1.8°F to outdoor nighttime temperatures. In genuinely hot cities, such as Phoenix in the summer months, air conditioning can consume up to half of all the electricity on the grid.[17]

Switching to renewable energy will radically reduce emissions of greenhouse gases and other air pollutants. Solar, wind, hydro, wave, tidal, and geothermal sources can be utilized in a mix of centralized and decentralized (distributed) electricity generation.[18] Distributed energy sources have the advantage of reducing the electric grid’s needed length and capacity while reducing the amount of electricity lost in long-distance transmission.

Although the intention is to move to 100 percent renewable energy throughout society as quickly as possible, and the technologies are available

to take us there, at the present time there is no easy way to replace fossil fuels in air and sea transportation. Running planes on alternative forms of energy will need examining. There might even be a return to near complete reliance on sail technology for ships, which has advanced significantly in recent years. Sails, at least on smaller cargo vessels, may well have a new lease on life for ocean shipping in an era in which efficiency and speed are not of tantamount importance to the economics of the system.

We must always be mindful that each renewable technology comes with its own drawbacks and requires energy and other resources, many nonrenewable, in order to construct facilities. For example, "one 5-megawatt [wind or marine] turbine requires a ton of rare earths, the mining and refining of which will leave behind 75 cubic meters of toxic acidic waste water and one ton of radioactive sludge."[19] While less damaging ways need to be found to refine rare earth metals, these drawbacks pale beside the continued use of fossil fuels. In an ecological society, mining, treatment of mining wastes, and the recovery of materials will all be prioritized differently, with human and ecological health in first, not last, place.

Other detrimental environmental effects of renewable energy may also occur, such as bird and bat deaths at wind installations and obstructed fish migration due to hydropower dams. Ways need to be found through design and siting of facilities to minimize these effects. Large dams for hydropower are inefficient and gigantically expensive. Historically, their construction has resulted in the forcible displacement of local populations and the drowning of cultural sites and areas of natural beauty. But micro-hydropower systems from small dams to microturbines in pipes carrying water by gravity—both now in actual use—offer additional possibilities for renewable energy production.[20]

The biggest benefit of renewable energy is, of course, that it's renewable. Aside from maintenance, upgrades, and eventual replacement, once wind turbines and solar panels are built, the energy is free and requires no more mining or resource use for long periods of time. If society simultaneously mines and uses materials more effectively *and reclaims significantly more materials at the end of the useful life of all infrastructure*, energy production and use will be a much less significant issue, not to mention far less polluting of the atmosphere and people's bodies.

Studies have shown that it's entirely feasible to replace electricity generation from fossil fuels, primarily coal and natural gas, with renewable sources. The sun provides over 170,000 terawatts (TW) of power to Earth each day. With this incoming energy approximately 10,000 times more than the total daily energy used by humans, there is quite a bit more solar energy that can be captured by PV systems or used to directly heat water.

Two oft-cited drawbacks to wind and solar energy are that they are intermittent and the electricity generated is difficult to store.[21] The intermittency problem can be solved in a number of ways. Individual users, as well as industry will be encouraged to use the most energy when solar and wind are actively generating electricity and less during other periods of the day.[22] Smart grids, whereby energy generation can flow in and out of the system from distributed power systems, and real-time energy monitoring can smooth out flow.

Considering that workdays and workweeks will be considerably shorter, it will be much easier to stagger when people work to different times of the day so as to smooth out and equalize transportation needs and energy generation. Distributed and relatively small-scale systems spread over different regions can be integrated so that the mix of different forms of energy generation complement each other and overlap. Additionally, if energy generation is combined with energy storage mechanisms, it will be more robust and reliable than conventional sources, which currently see one in three people in the United States without power at least once per year.

For example, the Niagara Falls hydropower station uses some of the energy produced at night to pump water back up to store in reservoirs, enhancing generating capacity the following day. Batteries are already being used for temporary storage on a commercial scale; companies such as J. C. Penney and Cargill charge them up during periods of the day when electricity is less expensive and draw them down when rates are high.[23] The flow battery—not new, but a different technology than standard batteries—is constantly being improved and reevaluated and may provide significant storage capability for helping to smooth out intermittent renewable power generation. Although larger than the lithium-ion battery in electric cars and the lead-acid battery used to start internal combustion vehicles, flow batteries have significant advantages when used for storage connected to the electric power grid. Though flow batteries cannot provide the sudden

energy surge needed to start a vehicle, they can discharge for a longer period and thus have great promise for backing up the grid and meeting capacity demands during periods of heavy electricity usage.[24]

One of the most efficient uses of solar energy is to heat water. The use of solar hot water installations, found on many rooftops in countries with reliable and plentiful sunshine, can produce a significant portion of needed hot water for family use as well as for a variety of industrial or agricultural uses. Solar systems—hot water heaters as well as PV cells—may be problematic in cloudy and cold regions, but the example of Germany, a country in Northern Europe not renowned for its balmy climate, is encouraging: in 2015, photovoltaic-generated electricity accounted for 7.5 percent of total electricity consumption. PV was found to supply 35 percent of momentary electricity needs on sunny weekdays and up to 50 percent on weekends and holidays.[25]

Society will have to decide how to provide energy for cooking and rural heating purposes. In the developed world most stoves currently use either electricity or natural gas, and many rural heating supply systems run on propane. In rural locations in the Global South with reliable solar energy, the use of outdoor solar ovens has proven successful. Electricity could be substituted for gas, but from a thermodynamic perspective it’s a poor use of such a high-grade source of energy. Decisions to do so will rest on analyses of local conditions and determination of what makes the most overall sense. However, usage of natural gas will decline significantly because gas-fired power stations will be phased out and there will be no fracking.

Fossil fuel production and consumption won’t drop to zero. For example, unless suitable substitutes are found, coal will still be needed to make steel. But fossil fuel consumption will radically decrease and CO_2 emissions will fall as transportation and energy production shifts away from fossil fuels and military and many commercial uses are eliminated. Air transportation will decline as superfluous business trips are eliminated, industries are relocated to wherever negative environmental effects are lowest, and there is more reliance on locally available resources for production of goods. The need for much of the importing and exporting that is currently required to make capitalism work will be eliminated. The petrochemical industry, even though its negative aspects will be vastly

reduced, will nevertheless need to continue to produce synthetic materials, reconstituted along more ecological lines. Though plastic is ubiquitous, oil for the petrochemical industry represents only 6 percent of its uses, the vast majority being reserved for refining into gasoline, diesel, kerosene, or fuel oil for transportation and heating.[26]

Plastic, based on petrochemicals and needing energy for production, is a useful substance in part because organisms are unable to attack it, it's not susceptible to rust, and it's cheap and almost infinitely malleable. Clearly, some uses of plastic make no ecological sense and plastics of all kinds litter the oceans. Virtually all plastic designed for single use will be eliminated—not just plastic bags. With plastic coming into contact with almost all food (even metal cans that contain food and drinks have epoxy liners containing plastics), plastic chemicals and their by-products—some of which are endocrine disrupters—leach into food and contaminate our bodies. Needless to say, we must find other ways to store food. One easy answer for many food storage applications is to return to glass containers as well as steel, and aluminum containers coated with nontoxic materials. Greater use of fresh produce instead of highly processed and packaged foods will have many benefits in addition to the reduction of plastic use.

On the other hand, plastic is better suited than traditional materials such as wood or metal for a host of purposes, and in many cases there is no other substitute. Plastic is superior for use in underground pipes for water infrastructure, as well as for many medical uses. We could still make nonfood containers out of plastic because it's so lightweight, it resists chemical and biological degradation, and it can be made with many different levels of strength, flexibility, and shape. But containers would have to be returnable and reusable, recycled and reclaimed as other materials are when they have reached the end of their serviceable lifetimes.

The real problem with recycling plastics is the way profit-seeking corporations mix additives and hundreds of different substances within a given polymer, a practice that contaminates each product and makes effective separation virtually impossible. The World Economic Forum reported in 2014:

> In pursuit of profitable value creation, companies have broadened the spectrum of materials used in today's (consumer) products in

> myriad creative and complex ways. In the world of plastics, the number of new polymers has continued to increase in the past decades, mostly driven by new combinations of existing monomers. New additives—whether heat stabilizers, pigments, flame retardants, antimicrobials or impact modifiers—have been the main driver of major innovations in polymer materials science. This has increased materials complexity exponentially within and beyond the four major classes of polymers in use across different industries and applications today.[27]

Beyond the manufacture of plastics from petrochemicals, significant advances have been made in the development of bioplastics, based on renewable biomass. It might become possible to replace some useful products made with petroleum-based plastics with bioplastics, assuming we are not growing the feedstock in competition with other necessary uses of land and replicating the errors of the biofuel industry.

Transportation

Eliminating the need for cars by most of the population through redesign of cities, the construction of light rail and tram lines, establishment of rural electric bus and van routes, and creation (or re-creation) of a convenient long-distance passenger rail network will mean a huge reduction in the global production of cars. There’s no reason trains and buses can’t be made as comfortable as cars, if not more so. So much money, time, expertise, resources, and advertising goes into cars because they are such a central commodity in the capitalist economy, marketed to epitomize individual freedom. Cars are sanctified as a status symbol for this reason, and because they are the linchpin of so much manufacturing in the oil, refining, asphalt, cement, construction, rubber, steel, and plastics industries. Their existence has made possible the large car-dependent suburbanized environments that waste so much land and energy.

When a society based on perpetual growth, where everyone is under constant stress to “get somewhere” fast, is replaced by one based on cooperation and solidarity, traveling with fellow humans will be a delight to

be savored rather than a time-sink to be minimized. The manufacture and use of gasoline for automobiles consumes almost half of the 80 million barrels of oil produced globally each and every day. The vast decrease in automobile production and use would in turn feed through into reductions in the need for concrete, steel, rubber, asphalt, paint, petroleum, and plastics, even if some auto factories were converted to produce wind turbines, solar panels, buses, and trains. All short-haul flights could be replaced with train or bus travel.

Reducing Waste

Earlier in this chapter we discussed that waste heat can be utilized to heat and cool homes in district energy systems and how a more rational public transportation system can use fewer resources and less energy. These examples barely scratch the surface of what can be done. Many current branches of industry and commerce can and should be eliminated. Weapons manufacturers, car companies, advertising and marketing programs, the security industry, insurance and financial sectors, the prison-industrial complex, and associated capitalist enterprises geared toward socially useless production will all be shut down. These industries are not just a waste of material resources; they are equally a waste of the lives of those who work in such socially unnecessary or actively counterproductive jobs.

The switch to agroecological methods of farming would radically reduce the need for the manufacture of petroleum-based pesticides and fertilizers—heavy energy consumers in modern industrial agriculture. Further agricultural waste reduction would occur with many smaller farms sharing the use of smaller scale equipment in place of individually owned equipment.

Goods that still use metal will need to be manufactured in such ways that make it relatively simple and safe to extract and recycle metals and other components. Metals are, in theory, infinitely recyclable. Dependence on reclaimed metals would therefore mean a massive reduction in new mining and refining of metal ores, which are highly energy-, water-, and chemical-intensive activities, not to mention hugely polluting and with significant health risks for the workers and nearby communities. The

enormous waste of resources inherent in the practice of each family individually owning one or more cars, household appliances, power tools, and gardening equipment will be eliminated by their social provision. Rather than items like cars, power drills, and washing machines standing idle—an individual car sits unused 95 percent of the time—these articles and many more could all be provided at locations within the community, free for use as required. Even in some communities today, gardening tools can be borrowed through the public library, a practice that will be vastly enlarged in scope with the creation of an ecological society.

Instead of being designed and built for short life spans and obsolescence in order to increase profits, all products will be built to the highest degree of longevity practical, using the most energy- and resource-efficient methods and materials. All of these factors will radically reduce resource throughput while enhancing everyone's lives. It will also mean that the labor that goes into making disposable products and is therefore currently wasted, will be put toward much more fulfilling and productive uses.

Much of household waste that currently goes into landfill can be radically reduced. Even the buried landfills will be eliminated. Today, single-sort recycling, with materials being separated for reuse at a materials recovery facility, conversion of remaining waste into electric energy by incineration, and other innovations (not without their own problems) have somewhat reduced quantities of household waste ending up in landfills; still, almost 70 percent of waste in the United States goes into landfills. (Percentages are much smaller in some European countries such as Germany, Belgium, and Austria.)[28]

The systematic separation of all organic waste from the waste stream will allow it to be fed to farm animals or turned into compost. Even the word *waste* is problematic if we reconceive of production and consumption as circular rather than linear. What is wasteful to capitalism is forgoing opportunities for making money. Conversely, what is efficient is that which maximizes profit. What is wasteful for an ecologically based and socially oriented society is for items to be needlessly discarded or for excess energy or resources to be used in their manufacture; what is efficient is that which minimizes material resources, labor, and energy inputs. The "waste" from the fabrication of an industrial product, and the product itself when it is worn out and needs to be replaced, should, where possible, become an input

for another product or process. William McDonough and Michael Braungart have popularized this circular system in their book *Cradle to Cradle*.[29] Design and production of goods and buildings need not only consider the waste occurring during the process of construction and use but also to make it as easy as possible to reuse the components in the future or convert buildings to other purposes than originally planned.

Creating Healthy Cities

For the first time in human history, more than half the global population lives in cities, many of those in slums, and that proportion continues to grow. With little or no choice, people continue to move into cities because of flight from wars, persistent droughts heightened by global climate change, rural poverty and lack of employment; the countryside is still being actively depopulated in large portions of the world because of land grabs by capitalist firms and sovereign wealth funds working hand-in-hand with corrupt local officials.[30] With a less dependable climate threatening crop yields—too many hot days, droughts, and floods threatening yields—millions, perhaps hundreds of millions, more climate refugees are to be expected. Despite the rural exodus, small farms in the Global South continue to provide food for the majority of their people.

Low-density suburbs, with their strip malls and big-box stores, surround many cities, especially in the developed world, and rely almost exclusively on the ubiquitous automobile. Sixty million people in the United States live in suburbs far from their jobs, with little to no access to public transportation, creating the need to commute by automobile. In 2011, daily round-trip work commutes in the United States averaged around fifty minutes a day, while some 8 percent of the population traveled two or more hours to get to and from work.[31] This represents a tremendous waste of human and other resources, especially when one takes into account the resulting traffic jams, elevated stress levels, and lack of time to spend with friends and family or in cultural activities.

One of the key elements of an ecological society is an inclusive process in which all participate in planning and making critical decisions. With regard to cities, participation in decision making cannot be limited to

architects and professional city planners, but must include the people that these decisions will affect. While an ecological society will eradicate inequities in childcare responsibilities, job opportunities, and all other aspects of social life, the voice of all people, of all genders, ages, and abilities, will be essential in designing new cities and redesigning already-built cities to realize the goal of equal access and benefits for all.

Currently more than half of the world's people do not have access to the most basic sanitation facilities.[32] A future ecological society will comprehensively address sanitation for all. Addressing this urgent problem will increase the return of nutrients in human sewage to the soil, but without the contaminants from industrial production and products that are found in today's sludges and sewage effluents.[33] The world needs billions more toilets and many more sewage treatment facilities, even as we select, plan, and build better ones. The developing world can have state-of-the-art sanitation systems put in place that take into account not only people's immediate toilet needs but also longer-term issues of how to design and treat wastewater in the most ecologically sustainable manner possible.

The redesign and provision of sanitation facilities will be easier to carry out in cities that are still coming into being in the Global South, rather than in well-established ones in the developed world. An ecological and socially progressive approach to the design and arrangements of housing, other buildings, and open space in urban environments—parks, playing fields, squares, gardens, and urban agriculture—intersects with the need for new transportation systems and new ways to produce and use energy. Water use and management are deeply connected to the above issues.

It should be noted that inclusive planning for the design and construction of large-scale infrastructure projects cuts against popular notions that small-scale, local decision making is inherently better than larger bodies of people coming together, either in person or facilitated electronically via the Internet. A huge number of people need to be involved—directly and indirectly—in making decisions that affect an entire city or region. Whenever a municipality requires a new sanitation system, who will decide how and where a sewage treatment plant will be built and to what specifications?

London, a city of 8.8 million people, has over 40,000 miles of sewage pipes, 1.2 million manholes to access the pipes, more than 500 pumping

stations to move the water, and over 350 sewage treatment works.[34] All of this infrastructure employs hundreds of people, and can also generate energy from the waste sludge. The planning and decision-making process currently occurs outside the purview or oversight of almost all those who use the water; in London a forprofit corporation carries it out. Better outcomes will be obtained by involving the people directly affected by any decision to transform a neighborhood or an entire city—it cannot be left to a small handful of professional administrators. When wasteful aspects of the economy are done away with, some of the time freed up from reductions in the workweek will be devoted to meeting in person, online, or through conference calls to discuss and make important decisions on long-lasting infrastructure developments.

Local residents clearly need to be involved, but so do engineers, construction workers, and administrative workers to allocate resource needs. If treated water is to go back into the local river, as is done in many places in the world, downstream users would also need to be involved, and thus decision making would spread to the surrounding communities within the watershed.

If a new rail line is planned for a city, or between cities, many people will need to be involved to decide on the location of tracks, stations, timetables, construction schedules, and funding. In addition, as we will want many more areas serviced by public transport, we will make decisions about the number of people to be trained or retrained to drive vans, buses, trains, and subways, as well as to design, operate, build, and maintain railway systems. Furthermore, the involvement of even more people will be required to decide if there are enough schools, where they should be built, their design, how many teachers need training, and so on. In this way, not only will duplication be avoided, but everyone will be involved in decisions that affect their lives.

Over the long term cities will likely be smaller than today’s megalopolises. There are currently thirty-five metropolitan areas around the world with more than 20 million people. Cities would be better dispersed over the countryside, connected by efficient means of public transportation. This would facilitate the integration of urban and rural ecosystems, including their peoples. A goal would be to design closely interacting cities, towns, and rural areas to stimulate better management of water flows and

the cycling of nutrients transported to cities as food and then returned to agricultural soils. To maintain the health and productivity of soils, this would necessitate a vigorous program to keep industrial chemicals and chemicals from household products, hospitals, etc., from commingling with the waste stream that contains human bodily wastes.

In *Cities for People*, Jan Gehl, one of the forward-looking urban designers, suggests four social goals for cities:

- Liveliness, whereby cities are active and fun places in which to live and work.
- Visually interesting design, encouraging interactions among people and with soft edges where vegetation replaces the hard edges separating pedestrians from buildings, streets, open areas, and coastal borders.
- Safety, for people of all ages and abilities.
- Sustainability, with priority given to nonmotorized transport and human health, promoted by more walking and the absence of air pollutants.[35]

In an ecological society, cities will have significant amounts of open and green space dispersed throughout neighborhoods. Urban planners will need to address and reverse urban sprawl. On the other hand, new cities can be much more integrated places of food production, recreation, treatment of storm runoff (water regulation), energy generation, public transit hubs, and other work-related productive activities.

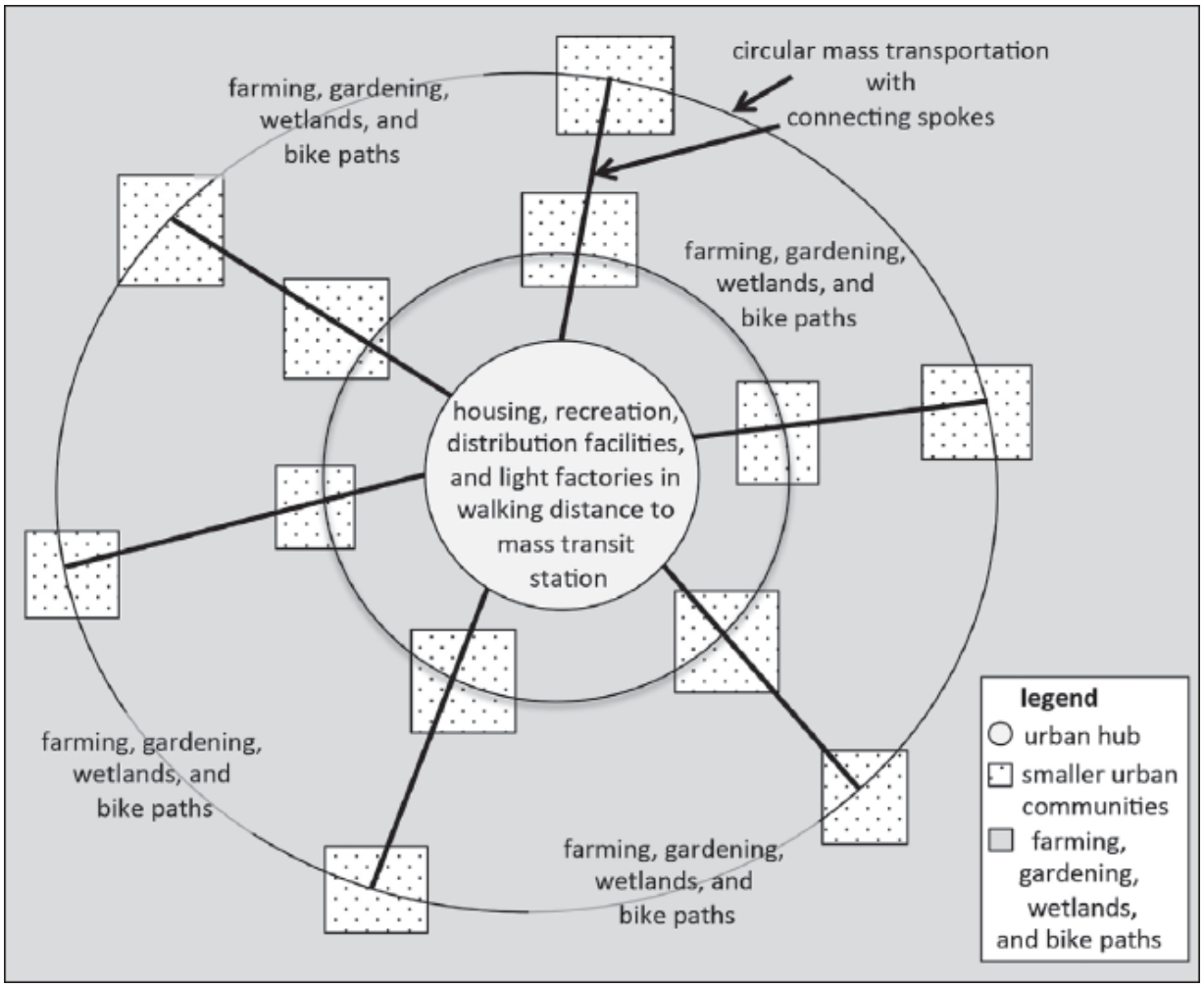
New cities could base light rail and bus transportation on a hub, spoke, and circle system (see Figure 10.1). The central urban core contains a transportation hub as well as concentrated areas of housing and workplaces. Housing will be built so that it is a relatively short walk or bike ride to a mass transit station. Areas between the spokes and circles can encompass farms and gardens as well as wetlands to accept and renovate urban and rural runoff waters as well as sewage water. Parks and gardens and other types of recreation facilities would be designed for the denser housing and workplace zones, while bike and walking paths provide easy access to the more rural areas.

Whether new intercity rail networks should be of the high-speed variety is an important question for a social-ecological society to consider. Under capitalism, faster trains facilitate the expansion of a city, eating up all the

green space between the metropolis and its satellite bedroom communities. Residents of these satellite municipalities have to spend many hours commuting to jobs in areas they can't afford to live in. Simultaneously, rural lines that branch off main commuting routes shrivel, further disconnecting smaller communities from the urban center.

The Shinkansen bullet train system in Japan was specifically designed to connect different Japanese regions to the capital, Tokyo. The result has been to turn the Greater Tokyo Metropolitan Area into a megalopolis of 35 million people, or 27 percent of the total Japanese population. As Philip Braso and Masako Tsubuku note, "The bullet train has sucked the country's workforce into Tokyo, rendering an increasingly huge part of the country little more than a bedroom community for the capital."[36] At the same time, "the Shinkansen's focus on Tokyo, and the subsequent emphasis on profitability over service, has also accelerated flight from the countryside. It's often easier to get from a regional capital to Tokyo than to the nearest neighboring city."[37] Despite this, more Shinkansen lines, and even faster trains, are being planned.

Figure 10.1: Urban Spaces Integrated with Farms, Gardens, and Wetlands


circular mass transportation with connecting spokes
farming, gardening, wetlands, and bike paths
farming, gardening, wetlands, and bike paths
housing, recreation, distribution facilities, and light factories in walking distance to mass transit station
farming, gardening, wetlands, and bike paths
farming, gardening, wetlands, and bike paths
legend
urban hub
smaller urban communities
farming, gardening, wetlands, and bike paths

Source: Fred Magdoff.

The need for speed is a prerequisite of capitalism. The aim is always to compress time in order to facilitate ever more production, ever-faster purchasing of commodities, and ever-faster capital accumulation. But the increasing speed of trains and other forms of transportation, alongside other capitalist innovations, such as fast food and regimented production lines, all act to dehumanize and alienate humans from taking the time to enjoy the journey itself, or a meal, or their work. Drastically reducing the workweek and redesigning all aspects of work to make jobs fulfilling and useful will provide people with more free time and lessen the importance of doing things quickly. This ethos will also underpin travel.

Though improved transportation networks will aid the interconnection of all of humanity, it is debatable whether land and sea transportation will become faster; perhaps it will become slower and more pleasant. Because soaring real estate prices will no longer be a problem, people will not be forced to move out of a gentrifying urban neighborhood (as there will be no gentry) into suburbs. There will therefore be no need for far-flung workforces to commute into a central economic hub. All the issues relating to developing ecologically and socially integrated communities will remain a question for debate as to how it can best be accomplished.

Apartments, houses, and other buildings in cities will be designed to be comfortable and long-lasting, while optimizing use of natural lighting, ventilation, and heating and cooling to minimize energy use. We can learn much from the design of structures and use of local materials practiced by pre-capitalist cultures. Connecting those features to what we've learned about energy, heat, and ventilation from passive methods of environmental control will enable us to efficiently control temperature and humidity of indoor spaces. Naturally, cities and buildings in different climatic regions will look quite different, taking into account variations in weather patterns, temperature gradients, the angle the sun strikes Earth during winter and summer, forms and amount of precipitation, and cultural and historical factors and preferences.

Architectural design will represent the merger of older knowledge about building resilient and comfortable structures with environmental factors and technological know-how we have acquired. Plantings in cities should consist of native species that can thrive in temperatures of the region and its pattern of precipitation.

Priorities during the transition to a socially just ecological society will include building healthy and quality housing for the homeless and poorly housed as well as integrating diverse communities. In the developed countries it is quite likely that more than enough housing exists already. Homelessness in those societies is not caused by a lack of houses but by lack of money in the hands of the poor and a lack of social responsibility toward the most vulnerable. According to the 2010 government census, the United States had more than five times the number of empty residential units as homeless people.

Internationally, many low-quality houses in poor neighborhoods will need to be demolished, along with shantytowns and squatter and refugee camps and new apartments and houses in pleasant communities constructed for former slum dwellers.

Workplaces and places for provisioning people and providing for other needs—outdoor and indoor recreation facilities, cultural centers, health clinics, hospitals, dentist and optician offices, schools, and so on—will be interspersed in neighborhoods and easily accessible. In this way distinct neighborhoods will form in which people who live there will also go to school there and work in the community or nearby. If the primary goal of production is to provide for people's needs while limiting waste and controlling pollution, then it will be a lot easier to have production facilities closer to where people live.

A significant amount of urban space will be reacquired for public use by the massive reduction and need for individual vehicles. In modern cities, storage of vehicles when not in use presents almost as large a problem as when they are being driven. One-third of the surface area of cities such as Tampa and Los Angeles are given over to non-residential parking. Even if cars run on electricity produced with renewable energy sources, the negative impacts of a car-based society are immense: the abundance of space taken up by cars when not in use; the vast acreage of impermeable concrete required for storage; and the social isolation, sense of entitlement and individualism promoted by car ownership; and the tens of thousands killed and injured every year from traffic accidents in the United States alone. Consider the data compiled by Lester Brown in 2001:

> The United States, with its 214 million motor vehicles, has paved 3.9 million miles of roads, enough to circle the Earth at the equator 157 times. In addition to roads, cars require parking space. Imagine a parking lot for 214 million cars and trucks. If that is too difficult, try visualizing a parking lot for 1,000 cars and then imagine what 214,000 of these would look like.
>
> However we visualize it, the U.S. area devoted to roads and parking lots covers an estimated 61,000 square miles, an expanse approaching the size of the 51.9 million acres that U.S. farmers planted in wheat last year.[38]

In existing cities these vast areas of concrete and asphalt dedicated to the parking of cars will be ripped up and converted to public green space, recreational areas, bike paths, tree plantings, and gardening and farming areas.

Transportation services will be reorganized so people can easily travel to nearby forests, mountains, rivers, farms, and beaches to appreciate and rejuvenate. “Research has shown that addition of only two trees and a patch of grass to a concrete-dominated housing project can improve health, mood and school performance.”[39] Imagine the positive effect of greening all our city neighborhoods by providing open green spaces and easy access to the surrounding countryside.

One of the problems in many cities today is that their sewers receive and transmit human sewage as well as less polluted water from storm runoff. Separate city systems for storm and sewage water are rare. Facilities for treating sewage therefore become overloaded during high runoff events, frequently requiring the discharge of untreated sewage into nearby surface waters. There are two general approaches to the runoff problem: a) reducing the amount of runoff waters; and b) slowing down the flow so that less erosion occurs, particulates can settle out, and other cleansing can occur before water reaches a stream, pond, or lake. Some practices encourage both. Techniques for decreasing storm runoff include constructing green roofs; decreasing the percentage of impermeable surface area by using porous ground coverings; leaving spaces between paving stones; creating underground micro-water sinks to accept rainwater that can then infiltrate the subsoil; and creating playgrounds and public parks that can accept runoff, allowing it to percolate into permeable soils or move through wetlands, helping clean the water.

The decrease in runoff quantity and intensity needs to be paired with diversion of as much surface runoff as possible, either through dedicated sewers specifically for runoff or, better yet, channeling to nearby infiltration basins or parks containing wetlands. The development of “sponge cities” is possible, and is especially important in regions that lack sufficient water resources yet do have periods of significant amounts of precipitation. In light of climate change and sea level rise and the many cities that are built along coastal regions and at river mouths, there is a need to rebuild barrier islands, revive coastline sea grasses, mangroves, and salt marshes, and

create soft edges around cities to absorb storm surges and safely blend the city with its surrounding water.

Green roofs—gardens planted on top of buildings—are relatively new. Not only do they help intercept and slow down the flow of rainfall and runoff, they also insulate buildings from extreme heat and cold, reducing energy costs. And they increase the life of roofs by protecting them from UV radiation. Other little-studied benefits are only beginning to be recognized. The diverse microbial inhabitants living there may be an "underestimated component of these biotic systems functioning to support some of the valued ecological services of green roofs."[40] There are a variety of ways to clean runoff waters and sewage effluent in order to maintain surface water quality in canals, ponds, and lakes. One of these is to use either wetlands or systems that mimic the properties of wetlands. Undisturbed wetlands are extremely efficient at cleansing water as it makes its way through the landscape. Wetlands are composed of a complex mix of interacting organisms and habitats. When constructed for the purpose of treating polluted water, as ecological design pioneer John Todd explains, "the engineering is human but the cast of creatures that actually does the work is gathered from a diversity of wild systems." The organisms "organize themselves into new and complex living systems … a partnership between human designers and other life-forms with the objective of solving particular problems."[41] Humans have modified the ground, engineered the site, added plants and a variety of other organisms, and then let nature take its course. This concept can be applied to rehabilitation of polluted ponds and lakes, treatment of surface runoff, and renovation of sewage effluent.

There are substantial advantages to a reimagined urban space as a different type of ecosystem, rather than a degraded wasteland too densely packed with people. As cars are removed and industrial production is made more environmentally benign, with controls for gaseous, solid, and liquid wastes, the changes will result in an increase in urban space to grow food uncontaminated by toxins. Incorporating more food-growing areas into cities—including areas within dense development surrounding mass transit stops—may render rooftop food-producing gardens unnecessary, freeing up roofs as locations for solar panels. Perhaps green roofs with nonfood crops might be integrated with solar panels, maintaining their advantages of modulating water runoff and interior temperatures.

It’s worth reemphasizing the huge differences in the makeup and organization of the people who will be doing all this reimagined urban planning. Today people designing urban transformations are mostly drawn from a technocratic class of highly educated architects and engineers. They are given the task of maximizing commercial opportunities and the throughput of cars, energy, and water while keeping costs low, all in consultation with financiers and commercial real estate interests. It is highly unlikely that any of them live in or come from the neighborhood under consideration. In contrast, though there will still be experts trained in relevant fields, there may well be more local experts as well, and any decisions would be democratically arrived at and include the voices of those impacted by planning decisions. People educated using experiential methods designed to develop individuals who are more knowledgeable and well-rounded will be a vital part of the process. Furthermore, the objective will be to enhance the quality of life, which will mean enlarged green spaces, more variety in building design, and ease of transport for all members of society.

New methods, techniques, and approaches to producing the necessities of life and new ways of building or modifying cities are essential. But how will it all fit together and be organized? What are the bedrock principles and practices of social organization in an equitable ecological society? What values and ways of relating to one another and to the rest of the natural world will allow for the changes sketched above to take place? These are the subjects of the next chapter.

PART FOUR

Toward a New Society

11

Living in an Ecological Society

> The absence of a vision for the future, of a project, of a radical alternative cripples and paralyzes the potential movement from below and may divert it in dangerous directions.
>
> —Daniel Singer[1]

There's an old saying that's as true for society as it is for individuals: the two most important things to know are where you come from and where you're going. For the last few hundred years we've been locked into a capitalist economy and worldview based on cutthroat competition and deep structural inequity. Its history has made it abundantly clear that differences in wealth lead to differences in power. Private wealth accumulation is the enemy of political and social equality.

In this system we don't decide where factories are located, who gets jobs, how much time we work, how our energy is produced, or other such economic decisions that affect our lives.

What we need now is a vision of a very different society—one that is organized cooperatively, equitably, and democratically from the bottom up. In this society and its communities all humans are treated equally and natural systems with their processes and cycles are allowed to function in a healthy and sustaining manner.

The only way such a society is possible is through the conscious and rational management of human interactions with the rest of the natural world. We need to build healthy ecosystems while preserving renewable and nonrenewable resources for future generations. The way the economy functions—how humans relate to one another to obtain the things we need

to flourish collectively—should promote the goals of equity, justice, and ecological health. Economic and social relations must encourage and facilitate the development and expression of everyone's full potential in ways that keep the world in which we are embedded functioning and healthy over the long term.

This means that we need an economy designed to be at the service of humanity, regenerating and maintaining the health of the biosphere, upon which we and other species depend, an economy without the compulsion for exponential growth, able to function well while constantly evolving. This is an ecological society. Because it will be under democratic social control instead of in private hands and must encompass substantive equality to be sustainable, it can also be described as a socialist one. Ecosocialism has come into wide use as a term for this vision to stress the importance of considering ecological approaches to human interactions with the rest of the natural world alongside equitable social relations. In other words, our concept of an "ecological society" is synonymous with "socialist" and "ecosocialist" ones—democratic and equitable, with production processes and facilities under the control of the people who do the work, and with the purpose of production to supply everyone with their needs in ecologically sound ways.

The values of a society reflect its economic and social organization. In order for an ecological society to thrive, people need to embrace a way of thinking similar to the Quechua peoples' social philosophy of *buen vivir*, meaning "living well." This refers to a life in which: our basic material needs are satisfied, but also through our activities and relationships and spiritual, mental, and artistic development are diverse and fulfilling, and we are "in harmony with nature." Our gains are measured socially rather than through an aggregation of material goods.

According to the Uruguayan scholar Eduardo Gudynas, the phrase *buen vivir*:

> includes the classical ideas of quality of life, but with the specific idea that well-being is only possible within a community. Furthermore, in most approaches the community concept is understood in an expanded sense, to include Nature. *Buen vivir* therefore embraces the broad notion of well-being and cohabitation

> with others and Nature. In this regard, the concept is also plural, as there are many different interpretations depending on cultural, historical and ecological setting.[2]

The concept of *buen vivir* implies that everyone would live a good life while living and working in harmony with nature. It is sometimes contrasted with the concept or phrase of "living better," which implies ever-increasing quantities and qualities of goods and services.

The people who will bring about an ecological society, on a global scale, must work out the details through a process of revolutionary change. There can be no preordained grand design. The ideas outlined here are put forward with humility for the purpose of stimulating thought and discussion. However, we must emphasize that they are not proposed as a grab bag of possibilities to pick and choose from. We view the various parts as needing each other in a mutually reinforcing and self-perpetuating fashion for the economy and society to function as desired.

Below, we describe characteristics and features for a world society and its economy based on *buen vivir*'s principles of social-ecological cooperation and communal well-being. In other words, a view of how a future ecological society might function.

Equality and Democratic Decision Making

The creation of an ecological society requires a society free of class divisions, in which people are treated equally and participate feely in society with equal access to resources and opportunities. There is nothing in our history, genetics, or so-called human nature that prevents such a future from becoming reality. "The free development of each is the condition for the free development of all," is how Marx and Engels described the concept. When the goal is for all members of society to have equal access to resources and opportunities needed for *buen vivir*, individual freedom is achieved within the social context.

True political democracy, where everyone has a meaningful voice, is only possible when there is economic equality and free access to information and education among all people. Through open and free debate,

humanity will collectively decide what constitutes the essentials of living well, how to come up with the most appropriate plans and enact them, and how to evaluate their successes and failures.

Needless to say, the active and equal involvement of everyone on the planet will require the eradication of unequal power relationships among people based on social class (or caste), race, gender, and sexuality. Instead everyone will have equal access to the necessities, including resources, technology, education, meaningful work, and leisure time. This will be the most immediate task in an economy based on equality, sharing, cooperation, and bottom-up democracy. Another essential and urgent issue will be how to transition different regions to create more balanced economies. Capital has dictated that less developed countries concentrate their economies where they supposedly have "comparative advantage" in the marketplace, condemning many to focus on extracting resources and the sale of raw commodities such as foodstuffs and metal ores, while sustainable industries remain largely underdeveloped.

Full Participation

A goal of an ecological society will be to ensure that everyone can participate as fully as possible, and on an equal basis, regardless of age, level of ability, or health; many more social resources will be allocated to make this possible. People with disabilities will decide how they can best participate in the economic, political, and social life and society will be obligated to facilitate their decisions. Accommodation will be made for people who are unable to work. At the same time, the elderly will not be shunted off into social exclusion once their so-called productive life has ended.

The principle of encouraging the rotation of positions in all levels of society is an important tool for human growth and it guards against the development of a self-perpetuating bureaucracy. To allow for continuity of programs and institutional memory, past leaders will be expected to offer their services and knowledge as advisers to new leadership. To ensure that corruption does not creep in, there can be no extra perks or payment for these roles, nor will elected representatives be able to handpick new teams

of advisers to stack the system. Term limits are often advocated in existing capitalist societies as a way to overcome the entrenchment of politicians, but they could actually undermine direct democracy by forcing unwanted or untimely changes in leadership. Instead of term limits, people elected to any role will be subject to instant recall votes whenever the electorate desires.

Providing for a Full Life

Economic rationing based on wealth will disappear. Therefore, we need to decide what goods and services everyone should have access to and how they will be provided. This includes at a minimum high-quality, nutritious, and varied food, potable drinking water, clothing, housing, communication, transportation, access to energy and technology, heating and cooling, education, healthcare, and sanitation facilities, recreation and cultural opportunities, access to parks, outdoor activities and travel, and a clean and healthy local, regional, and global environment. The vast majority of the world's people will have many more goods, services, and life opportunities than under capitalism. Those previously in the upper middle class and the very wealthy will have less, but enough to meet all their essential and multifaceted needs, the same as everyone else.

What should be available in each home and what can be available communally needs to be reconceived. Most of the things we take for granted as essential in today's developed countries—such as power tools, washing machines, and even cars—are rarely used on a daily basis. These items can be easily shared through many community centers.

The production and provision of goods and services will be managed by the population and apportioned with respect to minimizing adverse environmental effects over the long term. Instead of the market and an individual's income determining how much one has, no one will go without. When everyone has enough for personal and communal needs, attempts to acquire more than others will be socially unacceptable and viewed as antisocial behavior.

We will not be able to do or have anything we might please, nor will we be free of pain and suffering. We will, however, be able live a full life while still recognizing that there are limits. Living well is not just an issue of

universal access to basic goods and services, it is also a matter of cultivating and giving ample opportunities to enhance social relations of cooperation, sharing, and exploration of cultural or other activities. There is an incentive for society to strive to reduce the time spent working on productive activities: “The less time society requires to produce corn, livestock, etc., the more time it wins for other production, material or spiritual.”[3]

To create a *social human* means to expand the senses, rather than a society in which “the dealer in minerals sees only the commercial value but not the beauty and the specific character of the mineral: he has no mineralogical sense,” a new society calls for the all-around development of our senses to appreciate nature and the world in all its manifestations and beauty.[4]

Individuals, communities, and regions will follow their interests and tastes as they pursue cultural activities, allowing a diverse human culture to flourish, rather than the globalized cultural monoculture foisted on us by transnational corporations, producing and selling the same products. We will develop what Marx calls “a totality of the manifestations of life” as a central feature of the new society.

Rights and Responsibilities

A basic set of economic, political, and social rights, responsibilities, and laws will need to be democratically developed and upheld by popularly elected local, regional, and multiregional councils that will eventually become networked across the globe. New ways of behaving—completely different from the idea of individual rights under capitalism—will be designed and upheld by mass participation.

With the vast expansion of the Internet and possibilities for instant communication on every geographical and community level, it will be easy for every person to take part in discussions and vote on all manner of economic decisions that have implications for resource use, methods and quantities of production, infrastructure, and every other decision taken by society. Electronic communications will not replace community and

regional meetings, however, because this is where issues will be thrashed out and debated before important decisions are made.

To provide equality in treatment, access to resources, and opportunity for all people, the historical injustices of racism and colonial oppression will need to be addressed. Justly resolving claims of indigenous and other historically oppressed communities will be given priority, with resources provided for these communities to develop economically and socially.

In an early effort, massive amounts of resources and technological know-how will need to flow to poor regions and countries to eradicate centuries of inequality, imperialism, and racism. Until industries are transformed (or eliminated) so they can't pollute the biosphere, they will have to be located equitably, so there is no more environmental racism. More schools and hospitals will need to be built to provide everyone with the best education and high-quality healthcare, and more teachers, doctors, and nurses will be trained to work in them.

The Economy

The aims, location, and control of production need to be decided and then organized so that the economy functions to serve society's needs. These cannot happen in haphazard ways, but must be discussed and decided by the people. A framework needs to be developed to help organize the changes and assist the continued functioning of the economy. As a new society is developed, experimentation needs to be an integral feature as new methods and techniques are tried. Freedom is needed for people to make mistakes and learn from them.

Planning for People and the Environment

An economy that has a social purpose—one that by its nature includes ecological considerations—must involve considerable active democratic management. In the transition from a capitalist economy to an ecological economy, production workers, scientists, engineers, and planners will need to develop environmentally and socially sound ways of working together to manage resources used to produce needed goods and services.

Because of the bureaucratic, top-down state planning characterized by the USSR and other countries claiming the mantle of Marx, the idea of economic planning has an understandably poor reputation.[5] Conversely, neoliberal capitalism has put its own negative ideological spin on the issue by denying the potential effectiveness of *any* government planning for the public good.[6]

Yet even capitalist states opt for the increased role of government in the economy during wartime. Wars require mobilizations of people, resources, and production facilities. During World War I and II, for example, the war effort required the wholesale mobilization of the economy. Planning to supply war needs was essential because market forces could not be relied upon to efficiently allocate limited resources. There was too much competition among the various military services and between the needs of the military and the civilian population for resources, so to mitigate this, private civilian use was rationed. Without planning, there was no way to ensure that a particular part would arrive at the right factory at the right time to produce a tank or that there would be sufficient food supplies.

In an ecological society, however, planning becomes a process for ensuring democratic control of the economy. Once an economy has a social purpose, it is not possible to operate without a lot more coordination and planning than occurs under capitalism. Without a planned democratic system of production and distribution, there is no way to ensure *buen vivir* for all people. It is not possible for markets to allocate resources effectively, equitably, and sustainably—from either a social or an environmental viewpoint. Nor is it possible to price goods in an ecologically and socially responsible manner.

Planning for short-term and long-term social needs begins at the community level as has happened in a limited way with the over 30,000 community councils of Venezuela, though they are still subject to overall capitalist economic relations. The system of councils must be intertwined and coordinated with other communities in a regional plan. Regional plans need to be intertwined with multiregional plans that are, eventually, coordinated across the whole world, with attention and sensitivity to local environmental and climatological conditions, natural resource constraints, and cultural desires and differences. For example, we cannot hope to solve

global climate change without a coordinated plan that involves the whole of human society.

There may be markets in an ecological society for the purpose of trading materials, as there have been since long before the existence of capitalism. In an economy of substantive equality where basic needs are met, perhaps markets may provide some information to planners, certainly immediately after the demise of capitalism. As Harry Magdoff notes:

> It would be necessary first to reorder the social relations within the society, achieve equitable terms between the nations that buy and sell raw materials, start on the road to equality and the abolition of classes, and provide plenty of latitude for the creation and use of a healthy surplus for nonmarket activities. Then, perhaps, the resultant price schedules might assist in guiding the economy.[7]

The point is not whether there are markets, or even whether money or some money equivalent is used. What is important is that relations among humans will be non-exploitative, people will be valued equally, and market relations will not control decisions about what basic needs are required for everyone and how to produce and distribute for those needs. In the event that an item is scarce, temporary rationing will ensure that everyone has a fair share.[8]

Once socially determined material and nonmaterial human needs are equally met across the world, the economy will stop growing. An ecological society has no built-in need for growth. Instead it will evolve in new ways as we come to a better understanding of how to function in concert with natural processes and laws. Capitalism is compelled toward exponential growth because of its drive to obtain increased profits without end in a competitive system. Even if populations decrease, as they currently are in Japan and most of Europe, the GDP of a capitalist economy must continually increase or the country is in economic crisis. However, there is no such problem in an economy based on satisfying human needs instead of profits.

Research and development will have goals that are compatible with an ecological society and will involve many more human minds than are currently brought to bear. Citizen-scientists will work with those who have

more formal training. Some of the results will help us better manage our interactions with resources, while other findings will expand our knowledge in ways that might not have practical implications. Rather than an end to innovation in science, it will be a new beginning of far more creative innovation.

Production Aims

In chapter 10 we presented a variety of concepts about ecological approaches to production. Energy would come from renewable sources and, whenever possible, used near where it is produced. Because much of the world lives in energy poverty, reductions in energy use in one region, or by the previously more affluent within one country, will be offset by increases in consumption elsewhere in order to bring everyone up to an equivalent level of comfort.

Also discussed were approaches to food production based on ecological principles, with greater integration of animal and crop farming. Ecologically sound and productive agriculture will be an essential facet of the economy. This may mean smaller farms with more people working on them, rather than the labor-efficient factory-size operations currently promoted by the capitalist agribusiness. These farmers should be able to produce high yields per acre but will have lower output per hour of labor.

Naturally, ways will be explored to lessen the burden of onerous jobs and redesign them using technology. However, the drive to replace labor with machines—integral to an economic system driven by the profit motive—will not play the same role. New machines will be invented, but their purpose will be to make working more enjoyable, to mitigate the time and human labor required for production, and to minimize the ecological impact of production.

Production will not be designed to foster even more production. There will be no more need for capitalism's built-in obsolescence and drive for profits. Houses and goods will be built and designed to serve their purposes as effectively as possible, incorporating entirely new forms of artistry. The new society will need many more architects, artists, designers, and engineers drawn from a wide range of technical and artistic backgrounds.

Aesthetically, culturally, and ecologically pleasing buildings of a wide variety of designs will no longer be the exception, but the norm.

Methods and aims of industrial production and building construction will be such that goods and buildings will have a long life and be easily repaired, repurposed, and recycled.[9] Wherever practical, leftover materials from production of one item will become inputs for another. Regular maintenance of manufactured items and buildings will drastically reduce the need to build replacements. When improvements are made or when products reach the end of their lifetime, people will be able to return items to distribution centers for replacement.

Nonrenewable resources will be used sparingly and recycled efficiently, and renewable replacements will be sought out and developed. Buildings will be as energy-efficient as possible. In general, all forms of production will aim for neutral or positive side effects for society as energy, resource use, labor time, and waste are minimized.

Location of Production

The more a community, town, city, or region can rely on its own or nearby resources, the better it is able to avoid potential problems with providing its inhabitants with the basics of life, and the better it can withstand problems that do arise. To the extent that it makes ecological and social sense, each community and region will strive for self-sufficiency of basic needs by relying on locally available resources for water, energy, food, housing, and healthcare.

An *absolute* requirement of local and regional self-sufficiency makes little sense for many reasons: after all, ecosystems with little human disturbance frequently rely on resources from outside the local area. Even if it were possible to do so, complete self-sufficiency would work against the benefits of a globally integrated and cooperative human society able to apply the full range of resources to provide for everyone’s needs equally.

Most durable goods, such as railcars, refrigerators, or computers, will be produce in relatively few locations, but will require resources and/or components from across large distances, requiring extensive cooperation and coordination. And though local and regional farmers will produced

some staple foods, others such as tropical fruits will need to be grown where the appropriate climate, soils, and topography exist.

It makes environmental and common sense to produce certain goods and have certain services only in selected locations—not in every town or city. Small communities will rely on health clinics, but large, fully staffed hospitals ready to deal with a wide range of medical issues should be within reasonable distance and available to everyone.

The approach of stressing local production of basic goods and services based on the utilization of local resources, when it makes social and ecological sense to do so, helps to create resilient communities. It also minimizes the use of energy in transportation and provides for a more direct and simpler path to reach the public. For some locations, decentralized power supply, sewage systems to recycle nutrients, and water provision will make a region more resilient, use fewer resources, and be more sustainable. On the other hand, in some locations it will make more sense to move electricity longer distances through a grid from a solar farm located in a desert region and have cities connected up to more centralized water and sewage treatment systems. Details of appropriate locations for the production of goods and provision of services will need to be worked out in practice rather than according to a preexisting plan.

Given the diverse climate conditions and geographic areas that humans inhabit, as well as what resources are available in particular locations, the degree of self-sufficiency will differ greatly from region to region. We are not advocating that certain regions of the planet be abandoned because they require more outside resources than other regions, rather, we propose that the needs of different areas can be taken care of locally and by interaction and solidarity with the rest of society.

Some excess capacity for production at different geographic locations is important for resilience. People with similar skills are needed in any community; so is redundancy in critical production facilities for coping with unforeseen events. Should there be an extreme weather event causing local or regional disruption, the resources of the entire society will be mobilized to minimize harm and disturbance to people’s lives and repair the damage in the shortest possible time. This will be a radical departure from our current system. Human society will be much more globally and locally interconnected, promoting a new social and ecological resiliency.

Worker and Community Control of Workplaces and Resources

The local population—those who work and run the factories, shops of varying kinds, mines, fisheries, and farms—know their workplaces better than anyone. They also know that the decisions they make regarding their interactions with resources in the production process will have direct consequences for themselves, the environment, their communities, children, and future generations. They are in the best position to regulate metabolic relations with the rest of the natural world in and around their particular location.

Production controlled by workers and carried out for the purpose of satisfying basic needs of the population, instead of production of commodities for sale to make profits, implies enormous changes. With people having a totally different concept of what is important—the goal of *buen vivir* being to live a full life and develop one's interests and potentials—a totally different conception of wealth and value will develop, creating new ways of relating to one another and the productive process.

A huge portion of the population currently work in jobs in the wealthy countries of the North that would not be needed in an ecologically-minded society.[10] This will create the possibility for people to pursue jobs that are of social value such as teaching and health care and for everyone to work shorter hours, unless labor was needed to produce products for people in other regions of the region or world.

Communities will cooperatively manage resources such as nearby forests and fisheries to restore and perpetuate them for future generations. Conservation of and care for resources will become part of a society-wide land and water ethic. A completely different relationship with resources occurs when exploitation of coastal fisheries by industrial-scale trawlers is replaced with stewardship of nearby coastal fisheries managed by members of a fishing cooperative that works with the health of the environment, their children, and grandchildren in mind.

To continue with the example of how cooperatively managed fisheries will function, the exact size of any given fishing vessel or cooperative is not the dominant consideration. The critical factor is social control and management according to the long-term objectives of society while providing people with fish. Members of the cooperative will decide what

methods are used to catch enough fish to satisfy needs without compromising future fish stocks. The best local knowledge combined with the most complete scientific knowledge will determine strategies for fishing that accomplishes the goal of feeding people without undermining long-term sustainability.

If fish stocks need temporary replenishing, fishing communities will not be left to fend for themselves and endure unemployment, as they would be today. Assistance and alternative employment and retraining will be available. Society will collectively take care of all social and ecological needs so as to satisfy the goals of social equity and renewable resource longevity.

Workers Rotate Responsibilities

Rotation of jobs and responsibilities within workplaces is as important as the community, regional, and multiregional rotation of leadership. One already existing example of this is the Las Lajitas agricultural cooperative in Monte Verde, Venezuela, which was begun in the 1980s with the help of two liberation theology priests. It is one of the oldest cooperatives in the country and has been a prototype for Venezuela's cooperative movement. Omar Garcia, one of the eighty-three members of Las Lajitas, describes how the co-op operates, providing a glimpse of what is possible without bosses. Jobs are handled on a rotational basis, agreed to by common consent. This extends to jobs that people don't want to do as well. As Omar Garcia explains:

> Right now we have a fixed time, which is two months, in which each member takes on the accounting and administrative pieces. We have had some difficulty with people who don't like doing the administrative piece and they say "I can't do it, I am not going to take on this responsibility," but I think that each member has to take on this responsibility so that there is transparency so that we are equals.[11]

Garcia indicates that much has been learned from failings that commonly occur in cooperatives:

> The problem with many cooperatives and organizations is when they leave the economic aspect to two or three people, when they leave the economic management up to the president, the secretary and the treasurer; this is what often causes problems. So we are breaking this scheme, so that there is transparency and also so that we are learning as cooperative members, as farmers and as producers.[12]

Because people will obtain fulfillment through their work, there will be no need for bosses or managers, whose primary role under capitalism is to ensure that workers keep working as fast and as efficiently as possible. Production will be collectively self-managed and carried out in a planned manner for socially useful purposes for everyone's benefit. People will decide how to run their workplaces and determine their conditions and hours of work.

There will be no more mind-numbing, repetitive, pointless work such as that which exists for most people under capitalism. Work will be creative and self-organized by the workers, taking on properties more akin to art. Under capitalism, many people are required to work excessive hours to meet financial needs while others are denied full-time work so that businesses can avoid paying benefits and force workers to compete for low-paying jobs. In an ecological society, no one will be locked into a job for their entire productive life, but will instead be free to experiment with different types of work and get retrained and educated in several different occupations. Indeed, freedom to experiment and personally grow is an innate goal.

Community, Regional, and Inter-Regional Relations

Nation-states and national borders will disappear, to be replaced by regional associations that ignore national borders. Without national antagonisms or the need to think about the geopolitical balance of power, sharing of water, energy, and food across what are now national boundaries will be a normal —not to mention rational—practice, and one of the defining characteristics of the new society.

Each region has climate, water resources, soil, and cultural and historical skills and interests appropriate for particular sets of food types and production. Similarly, metals and minerals are found only at recoverable concentrations in specific geographic locations. So a substantial amount of movement of materials—more a sharing of resources, as opposed to "trade" in the capitalist sense—will continue.

The import and export of goods will no longer be based on the profit-and-loss columns of capitalist accounting and the financial gyrations of stock markets and private and institutional investors. Goods will not be preferentially produced wherever labor is cheapest and environmental regulations the most lax. Production and processing will not be situated next to the poorest communities, those least able to resist corporate malfeasance and racism. Interactions between and among communities and regions will be based on principles of reciprocity, solidarity, and mutual assistance.

Changing Ethics and Behavior Patterns

A socially equitable ecological-based society requires a value system that emphasizes compassion, cooperation, reciprocity and sharing, an appreciation of nature in all its complexity and beauty, and egalitarianism. *This means actively working to create new ethics that govern our relationships to the land, our fellow human beings, our communities, and other species with which we share the planet*. That is why it is critically important to develop responsible members of society through both education and active participation in the democratic decision-making process.

New ethics and behavior patterns will be forged during the struggle to create a new society out of the remnants of the old. The revolutionary process needs to include modeling of relationships and behavior that reflect the type of society we wish to bring into existence. Therefore it is important to ensure an absolute commitment to equality regardless of gender, race, or other social identifiers and to heed the voices of all participants.

Organizations today striving for system change need to begin modeling the reciprocity, cooperation, and selflessness that will be prominent human

characteristics in an ecological society. One example of such an effort is the Landless Workers Movement in Brazil (the *Movimento dos Trabalhadores Sem Terra*, MST). The MST has organized occupations that have resulted in settling 300,000 families on their own farms. In their education initiatives and land occupations MST leaders attempt to bring out and reinforce cooperative, nonsexist, and nonracist behavior. Many living in MST settlements have started to reframe their future in terms of "we" and "our," instead of "I" and "mine." In the Kurdish regions of Turkey, political organizing has gone to great lengths to transform a oppressive patriarchal culture to one of meaningful equality inside the home and in society. As Meral Dais Bestas, a female member of Parliament, explains: "I can't say everything is equal inside the home now…. But women are now comfortable saying [to men], 'If I'm in the kitchen, you should be in the kitchen too.'" And Plein Uces, an international relations student, explains how things have changed at home: "… my father consults me about everything now…. We discuss politics, I can openly confront him and now my family wants us to be more powerful. They tell me, 'Get a driver's license so you can stand on your own.'" The Zapatista movement of southern Mexico has also worked to build equality of women into their society as an important part of an overall transformation.[13]

Unless people are engaged in the struggle—unless they themselves have gone through the process of creating change through collective and individual acts of solidarity, reciprocity, and cooperation—they will not internalize democratic, egalitarian, and ecological values or be convinced of their necessity. New ethics and behavior patterns cannot simply be enacted by decree. Even after a new society has formed, new ethical attitudes will have to be actively reinforced—especially those needed to overcome long-standing discrimination, whether based on previous caste or class affiliation, race, gender, religion, or sexual orientation. As Prabhat Patnaik observed about the caste system in India:

> We must not fall victims to the illusion that economic factors alone can overcome caste prejudice, caste consciousness and caste oppression. To believe this is tantamount to re-creating the earlier illusion that capitalism would automatically overcome the old caste-based social structure. There has to be a conscious and direct assault

on the inherited structure of social inequality which calls for a socio-cultural revolution.[14]

The social mores and culture of the general population in a society based on equality will not allow racism, sexism, or other forms of oppression. Ultimately, as people come to grow up and live in a world without class inequality and oppression, treating segments of the population differently based on their gender, race, sexuality, different physical or mental abilities or other attributes will not even make sense; and laws against oppression will become superfluous. Prior to that, an entirely new legal system will need to be democratically enacted. The current police forces and courts will be dismantled, because the existing system is predicated on class rule, racism, and the protection and sanctity of private property, which will no longer exist.

There will be no more prisons! Needless to say, most crime that is punished under capitalism is related to poverty and against private property or driven by the social and psychological pressures created by this social system. This will no longer be relevant in the new society.

The goal in dealing with whatever antisocial or destructive behavior still exists will be to reintegrate the offender into the community as a fully functioning individual. In place of a complex, expensive, and punitive criminal justice system, a system of restorative justice will be organized to include accountability and making amends, education and counseling, and bringing together the offender and victim with other members of the community for reconciliation.[15]

New Patterns of Living, Work, and Leisure

Over time, cities will evolve to be more internally cohesive and more interconnected to agricultural areas and other cities via reliable public transportation systems. Cities will be designed to facilitate the meaningful participation of their inhabitants. New cities will be built as a series of connected neighborhoods, with people living near where they work and having easy access to educational and other facilities. In addition to

housing, workplaces, and distribution facilities, there will be sufficient space for cultural and recreational centers and significant green spaces.

Rural communities will become more culturally vibrant and active. There will be a greater investment in their infrastructure. All communities will be socially and economically much more diverse. If cars are still necessary in more rural or remote areas and for some specialized purposes, they will be communally owned and shared.

All people who can work will have a role in the economy. Writing about the meaning of work, Harry Magdoff dispelled the common belief that "people will work only if driven by an economic motive." He observed:

> This notion is refuted by many of the [non-capitalist] societies we know about, where non-economic work incentives predominate: social responsibility, tradition, desire for prestige, and pleasure in craftsmanship. Given the record of past changes in people's attitudes to the community and to their work, it is reasonable to assume that human nature will adapt, and adapt with enthusiasm, to a social order based on cooperation, elimination of a rigid division of labor, and the opportunity for a fuller development of the individual.[16]

Labor will always be needed to provide for human needs. When people live in hunter-gatherer communities, this is just a normal part of one's existence as it is for all other animals. Labor will certainly be needed in a future ecological society. However, necessary work can be more interesting and engaging, encouraging people to think of themselves as multi-talented, conceiving and executing tasks rather than performing as little more than cogs in an economy, doing dull and repetitive tasks.

Overcoming the Urban-Rural Divide

An important societal goal will be to overcome the urban-rural split that is symptomatic of capitalism. Although cities will be made healthier and more pleasant places and there is much that can be accomplished with urban agriculture, it is important to maintain a significant rural population. More farmers will be needed to work the land using ecologically sound practices.

Rural dwellers will have the same opportunities available to those in cities to live a *buen vivir*. Although farming may remain the primary occupation, other jobs will exist as all communities will be socially and economically much more diverse. There will be new technical and material support for small farms and small-scale light industry—as well as greatly improved housing, clean water, sanitation facilities, access to health care, and educational, recreational, and cultural opportunities.

Environmental Remediation and Regeneration

Cleaning up the toxic messes bequeathed to society by capitalism through the virtually untrammeled production of toxins and their release into the air, water, and soil will be a major long-term project of humanity. It will require the highest levels of global cooperation and coordination of best practices, utilizing our knowledge of bioremediation and other technologies.

The magnitude of the problem can seem overwhelming. Toxic waste sites around the world will require decontamination and remediation. For example, there are an estimated 30,000 abandoned mines on government property in the United States.[17] Cleaning up all the polluted soils in China will cost an estimated $1 trillion.[18] Dealing with the tens of thousands of tons of radioactive waste from nuclear reactors and weapons, and rendering harmless the stockpiles of biological and chemical weapons, will likewise require enormous resources and a long-term, coordinated plan.

The procedures chosen for decontamination and remediation should be those least likely to have negative side effects. A variety of phytoremediation techniques will have to be employed; for instance, planting cover crops that absorb heavy metals or increase soil organic matter, adding organic materials such as composts to stimulate biological activity in soil to break down industrial organic chemicals and so on. Land recently deforested for farming will be evaluated for reforestation to help absorb the excess carbon dioxide put into the air by two hundred years of burning coal, oil, and gas. Other remediation programs will include reforestation of fragile hillsides, stabilization of sand dunes and erosive soils with appropriate vegetation, rewilding of certain zones by reintroduction of animal and plant species native to the region, repair of the

damage done to riparian zones so as to allow rivers to flow more freely, and relocation of homes and other such structures out of flood zones.

Priority for the Nobodies

Even with everyone on the planet contributing, it will be a long process to overcome the toxic contaminants bequeathed to us by capitalism: to the soil, water, and atmosphere, to living creatures, as well as to the cycles of nature.

It will also take a long time to undo capitalism's social and psychological damage to humanity and create a society that heals the history of systemic exploitation, want, and oppression, and encourages all people to reach their full human potential. A first priority of such a healing society will be to ease the burden on the lives of the poor, the oppressed, the discarded—those whom Franz Fanon called "the wretched of the earth," and Eduardo Galeano called "nobodies." The speed and extent to which the new economic and social system improves the lives of those who exist on the fringe of a society that has no need for them—whether in urban slums or rural hovels—will be a critical indicator of the new society's direction and success.[19]

The principles, characteristics, and procedures sketched here offer a glimpse of another society—one that prioritizes equally the needs of all people and the requirements for maintaining a healthy biosphere. The difference between our present-day world and this new ecological society will be enormous. But the question remains: how do we get there from here? In chapter 12, we explore how to make the transition to an ecologically healthy and socially just society.

12

Revolution: Creating an Ecological Society

> Let's begin by saying that we are living through a very dangerous time. Everyone in this room is in one way or another aware of that. We are in a revolutionary situation, no matter how unpopular that word has become in this country. The society in which we live is desperately menaced … you must understand that in the attempt to correct so many generations of bad faith and cruelty, when it is operating not only in the classroom but in society, you will meet the most fantastic, the most brutal, and the most determined resistance. There is no point in pretending that this won't happen.
>
> —JAMES BALDWIN[1]

IN ORDER TO REPLACE CAPITALISM with an ecological society we need a revolution. Given that need, how do we get there from here? Let us summarize the main arguments made so far.

WHY WE NEED A REVOLUTION

The social-ecological crisis is upon us and is getting worse at an accelerating rate. The Trump administration introduces an entirely new dimension, potentially making social and ecological deterioration even more severe. Many people around the world continue to live deprived, precarious, and unnecessarily shortened lives with little hope for improvement. At the same time, a degraded environment threatens the lives and livelihoods of billions of people across the globe and calls into question the continuation of an interconnected human society. The equilibrium of

Earth's biogeochemical pathways is destabilizing because of the gigantic quantities of human-made chemicals that are being pumped into the atmosphere, the oceans, the soil, and the bodies and tissue of all living creatures. Changes to land use and climate are making it impossible for ecosystems to continue to function as they have; species are migrating to different ecozones; many are becoming extinct. We are tipping the Earth system into an entirely new state, one that humans have never experienced in our 200,000 years on this planet. Chaotic barbarism may well replace stable societies and some believe that our very existence as a species is threatened.

Possibilities for Reform

All progressive change in capitalist societies over the last few hundred years grew out of mass strikes and demonstrations, agitation, and other forms of direct action and civil disobedience—actions that forced legislators to acquiesce to the demands of the people. In the words of former slave and abolitionist Frederick Douglass: "If there is no struggle, there is no progress…. Power concedes nothing without a demand. It never did and it never will."[2]

Fighting for and winning real reforms is essential, yet reforms alone cannot solve the crisis. The social-ecological crisis will not disappear if we sweep away the aggressive deregulated form of capitalism known as neoliberalism or overturn the international free-trade treaties enacted in the last three decades. Rather, it is the way capitalism operates—the way the system *must* operate—that makes it so destructive. Economic exploitation and inequality in the service of profit, imperial competition, racism, sexism, and warfare for geopolitical advantage and access to resources are integral parts of capitalism. Bitterly fought-for and hard-won reforms are under constant threat of being reversed and undone as the balance of social power shifts back and forth. This is being amply demonstrated in the United States by the policy proposals and actions of the new Trump administration.

The ruling class will fight constantly to roll back any environmental or social reforms that threaten capital's profits or freedom to operate. And if they can't reverse a reform outright, they will take the long view, chipping

away at the edges: influencing governments to go soft on enforcing labor and environmental regulations; restricting funding to government agencies that are designed to enforce or implement the reforms; seeking out legal loopholes and work-arounds put in place by legislators. No social reform is ever fully accepted or deemed permanent by capital.

In the United States, the social programs of the 1930s through the 1960s—Social Security, Medicare, Medicaid, welfare, the rights of workers to form unions, the gains of the civil rights movements, of women, gay people, the elderly, the disabled—all can be gradually hollowed out over time or ended with a single blow. All social and ecological considerations are secondary to the imperative of capitalism: the accumulation of profits, kept secure in the hands of the ruling class. The United States ruling class took a more aggressive posture toward social reforms after the Second World War, and in the 1970s it forged an all-out attack on previous gains.[3] We should expect this class war from above to continue or intensify whenever it feels conditions permit and require it.

Need for System Change

Capitalism has no off switch, no mechanism for changing its basic methods of operation. No matter how bad things get, capitalists cannot change the fundamental imperative of the system—the drive for profit. A system to replace capitalism, one based on economic and political equality and ecologically sound economies is both possible and essential.

Cooperative relations and relative equality have been the norm for most of human existence and are still the guiding values in parts of the world today. In Part Two (chapters 5, 6, and 7) we showed that there is nothing inherent in humans, in our history, or in the way ecosystems function that prevents a completely different economic and social system based on such values from being successful. And although there is no guarantee that such a new society will solve the social and ecological problems we face, it is our only hope of doing so.

We currently have the resources and technological know-how to create a society that can supply everyone with the essentials of a good life. As the *Wall Street Journal* reported in the spring of 2015, unintentionally

underlining the contradictions that lie at the heart of capitalism: “The global economy is awash as never before in commodities like oil, cotton and iron ore, but also with capital and labor—a glut that presents several challenges as policy makers struggle to stoke demand.”[4] The richest 1 percent of the world’s population has accumulated so much wealth that, in 2016, this select group of individuals controlled more than half of the world’s estimated $255 trillion in private wealth. Their wealth is equivalent to about twice the total annual world production of goods and services. If we no longer spend trillions of dollars on nuclear weapons, the military and the arms trade, and on marketing, packaging, advertising, replication of production, overproduction, and built-in waste of all kinds, that money—and huge reservoirs of human knowledge and labor power—would become available to meet the needs of society and the planet.

If the available financial and material resources and human labor are freed up and put to use to solve the social and ecological problems currently facing Earth and its inhabitants, creation of an ecological society is eminently possible. More than enough resources exist to eradicate hunger, end poverty, and build the new infrastructure—for research and development, for sanitation, water, energy, housing, education, medical care, transportation, parks, industry, and agriculture—that is needed to provide everyone with a good quality of life.

A Vision of a New Society

We have outlined our ideas and views of the principles, practices, and characteristics of a society created for the purpose of establishing social equity and ecologically sound interactions between humans and the rest of the natural world. We have used the terms ecological, ecosocialist, and socialist as interchangeable descriptions of this type of society. Whatever we call it, such a society can only happen with revolutionary change, a complete rearrangement of social power, the end of capitalism and class-based society.

The word *revolution* is currently used by all manner of people in very different contexts. Some environmentalists and politicians talk of the need for an “energy revolution” or a “great transformation” in infrastructure, but

they believe that those things can be achieved through private-public collaboration without significantly altering the prevailing power relations. It is therefore important to define what we mean by revolution, which to us means the total rearrangement of social power and its reconstitution on the basis of substantive equality. In other words, the only way to create an ecologically based society is by creating a classless society based on cooperation and the democratic decisions of the entire population. Only by overturning current social relations is it possible to create a society compatible with the well-being of the planet and its people.

Just as capitalism replaced feudalism through a series of revolutions in the seventeenth and eighteenth centuries, replacing a ruling class of aristocrats and their functionaries with a new ruling class of capitalists, revolutions are necessary today to replace the capitalists and *their* functionaries.

It's Not Too Late

To those who say we are too late, we ask: Too late for what? To struggle for a better world means taking the world as it is and working to transform it. Although the ecological and political conditions and trends are in many respects quite desperate, we are not condemned to continue degrading the environment or our social conditions. Based on what has already happened —the release of greenhouse gases and a multitude of other pollutants into the environment—a certain amount of global warming will continue regardless of what we do, with all its negative side effects, and pollutants will contaminate the biosphere for a very long time.

However, we can stop the slide to an even more degraded Earth, poorer in species and in the health of remaining species. We can use the vast amount of available human and material resources to reorient the economy to benefit all people. An ecological society will allow us to do all the things that are currently off the table, that capitalism has repeatedly shown itself unable to achieve: providing all people with the ability to develop their full potential.

This goal can be accomplished in ways that regenerate and maintain fully functioning and healthy ecosystems by remediating the global

commons, halting land- and species-degrading practices, reforesting more areas, and planting wildlife corridors and other sanctuaries that wild nature can return to.

Organizing for Change: Building a Mass Movement

"An anti-capitalist political movement can start anywhere," writes David Harvey, noted professor of anthropology and geography. "The trick is to keep the political movement moving from one moment to another in mutually reinforcing ways."[5]

Even in a country like the United States where there has been relentless propaganda denying the existence of climate change, ordinary people recognize that it is happening and that human activity is the cause. According to a March 2016 Gallup poll, almost two-thirds of Americans believe that global warming, the driver of wider climate change, is underway and that it is caused by human activity. Fully 64 percent stated that they were worried either a "great deal" or a "fair amount" that global warming will affect them in their lifetimes; 41 percent said it represented a "serious threat."[6]

As for the economy, the May 23, 2016, cover of *Time* blazed the title "Capitalism: How to Save It." In that issue, Rana Foroohar cites a recent Harvard Institute of Politics poll that found only 42 percent of Americans aged nineteen to twenty-nine—and only a slight majority of older Americans—"supported capitalism." As the author notes, the poll indicates not only that millennials are comfortable with the socialist label, but that there is a general dissatisfaction and discomfort with the capitalist system. The data "shows Americans have plenty of concrete reasons to question their system," she says, highlighting the fact that workers have been getting a smaller slice of the economic pie while the median hourly wage of full-time workers, after adjusting for inflation, has increased by less than 4 percent during more than three decades.[7]

Abolishing an unequal and violent system, one that does not balk at destroying the resiliency and sustainability of the planet itself, will require a sustained, coordinated revolutionary mass movement: one that is centered on the power of working people to stop production when necessary, and has

the vision and capacity to bring into being a new and totally different society. This movement needs to recognize that power must be taken away from the capitalist class, its assistants and hangers-on, and placed in the hands of the people. The large number of issues we must resolve are those created or made worse by capitalism; the key to solving them is solidarity. The path forward is to recognize they can't be dealt with in a piecemeal fashion isolated from each other.

To be successful, any revolutionary upheaval will have to dwarf the mobilizations we have seen recently around the world and take place on a qualitatively different basis. It will have to be organized to reflect the principles of the future society and take control of the centers of production so as to bring capitalism to a halt. Factories, farms, businesses, entire neighborhoods, cities, larger geographical areas, and nation-states will have to come under the control of the people. Street demonstrations that are not tied to eventually achieving prolonged and generalized strike activity and to the systematic occupation and takeover of factories, businesses, farms, and schools will be insufficient for victory.

The speed with which decisions can be made today, as well as information about how successful revolutions can spread, hampers security crackdowns, and enhances the chances of solidarity revolutions. But we need to be prepared to exercise great caution and flexibility in communications because of the extent of government spying on citizens' electronic communications, particularly in the United States and the U.K., and the ability of the security apparatus to shut down Internet and cell phone service.

Overcoming Fragmentation

A sustained revolutionary process, one that attains the social-ecological goals we have set forth, will require the majority of the population to actively participate in the process of change. The need for a majority of the population to work toward transforming into a new society in a coordinated and organized approach raises the issue of how to overcome the staggering amount of fragmentation found among activist organizations.

To fill the gap left by the decline in public delivery of much-needed services and the lack of large radical political organizations with broad agendas, single-issue non-governmental organizations (NGOs) have become the main expression of the fight for social and ecological progress. Many receive some or all of their funding from businesses and foundations that can then influence a group's message. This leads to increased conservatism in formerly more politically combative organizations.

An additional factor in the rise of NGOs was the late twentieth-century demise of highly centralized and dictatorial regimes that labeled themselves socialist. This has led many activists, particularly in the United States, to reject formal large-scale membership organizations in favor of small, single-issue-oriented groups arranged in loose ad hoc networks.

Older notions of solidarity are no longer as attractive to a new generation of worker-activists, trade unionists, and intellectuals. There has been an ideological assault on collective action, making it difficult to build an ongoing movement for broad social-ecological change based in factories, businesses, fields, and campuses.

Some actually consider the current political and organizational fragmentation to be a good thing. Even those who believe that systemic change is necessary are convinced that numerous formally splintered, "horizontal" efforts may somehow gradually coalesce into a larger, more amorphous force that will foreshadow important aspects of the new society by experimenting at the local level with direct democracy and new economic arrangements.

If we are to stand a chance of taking on the forces arrayed against us, it's clear that we will need some kind of long-term organization, or series of connected organizations, held accountable by an informed and active membership dedicated to a democratically decided upon program. The social activist and author of *This Changes Everything*, Naomi Klein, recognizes some of the limitations inherent in the idea of "spontaneous coalescing" and "horizontalist organizing":

> I have, in the past, strongly defended the right of young movements to their amorphous structures—which means rejecting identifiable leadership or eschewing programmatic demands. And there is no question that old political habits and structures must be reinvented

> to reflect the new realities, as well as past failures. But … as many are coming to realize, the fetish for structurelessness, the rebellion against any kind of institutionalization, is not a luxury today's transformative movements can afford….
>
> In practice, that means that, despite endless griping, tweeting, flashmobbing, and occupying, we collectively lack many of the tools that built and sustained transformative movements of the past.[8]

There is a growing recognition that fragmented and single-issue groups need to link up because all the struggles for social, economic, and environmental justice are really the same struggle, and must be united to challenge capitalism if there is to be lasting change. No amount of tinkering with the current system will be sufficient: changing the system is the only path to a humane and ecological society. As Mark Bittman explained in his *New York Times* food column:

> I have spent a great deal of time talking about the food movement and its potential, because to truly change the food system you really have to change just about everything: good nutrition stems from access to good food; access to good food isn't going to happen without economic justice; that isn't going to happen without taxing the superrich; and so on. The same is true of other issues: You can't fix climate change or the environment without stopping the unlimited exploitation of natural and human resources…. Same with social well-being. Everything affects everything.[9]

There are indications that many people are coming to such an understanding, that the various struggles are really all part of a single overall goal—for a humane, just, and ecologically sound future. For instance, at the People's Climate March in New York City in September 2014, hundreds of thousands of people participated, from all sorts of groups with varying mainstream concerns. Unions, community groups, civil rights and Native American organizations, social and environmental justice groups, and many others united with a variety of environmental groups for the effort.

Similarly, the Black Lives Matter movement has involved many who previously might not have placed racial justice at the top of their agendas but who are beginning to see that, in addition to being a clear moral imperative, the fight against racism is an essential part of a more general fight against an unjust system. And Black Lives Matter, in turn, has endorsed the BDS (Boycott, Divest, and Sanctions) movement against Israeli apartheid, recognizing that the United States, with its military and political support, is "complicit in the genocide taking place against the Palestinian people."[10]

The 2016 Standing Rock actions against the Dakota Access pipeline mobilized support from hundreds of tribes, environmental organizations, city governments, veterans, and others around the world, eventually leading to an encampment of over 10,000 people that successfully forced the United States government to intervene and stop the pipeline. It is a living example of the words of a song written by union organizer Joe Hill over a century ago: "There is power in a band of working men, when they stand hand-in-hand."[11] (On the other hand, the decisions on the Dakota Access and the Keystone XL pipelines have been overturned in the early days of the Trump administration, providing us with another example—capitalist reforms can never be counted on to be permanent or effective. These pipelines will make it easier to exploit the especially polluting Bakken Shale oil deposits in North Dakota and the Alberta, Canada, tar sands.)

University students from various organizations have begun to realize that there is considerable strength gained by uniting their struggles. This 2015 AP news story highlights the organizing efforts of a Columbia University student who, since her freshman year, has been one of the leaders of a high-profile campus climate justice campaign:

> Beyond the call for divestments, students have thrown other causes into the mix. After fighting to get Columbia University to divest from fossil fuels, a student group organized a coalition with five other campus groups that tackle issues such as racism, sexual assault and workers' rights. Together, as the Barnard Columbia Solidarity Network, they issued merged demands to campus administrators. "I don't think they've dealt with anything like this," said Daniela

Lapidous, a senior and a group member. “Only by building these coalitions will we win any of our demands.”[12]

An extraordinary push toward solidarity began within the January 21, 2017, massive anti-Trump Women’s March on Washington, drawing in people from, large variety of social and environmental organizations. Trump and his advisors have quickly made clear that they have a broad retrograde agenda that will potentially harm large segments of the population and the biosphere. As people realize this, and with the absurd and outrageous statements and actions pouring forth from Trump and others in the administration, a new wave of solidarity among social and environmental groups has taken hold that builds on the Women’s March. An article in the *New York Times* describes the response: “Call it Protest Nation: Activists across the country have been strengthening old partnerships and building new ones.”[13] This is the type of a political moment in which it is quite possible to build a strong and united organization or lasting coalition dedicated to radical socioeconomic change.

An example of solidarity that comes from long ago illustrates the sentiment of an old union slogan; an injury to one is an injury to all. As attacks against the Plains Indians escalated during the construction of the transcontinental railroad in 1869, the abolitionist and women’s rights campaigner Wendell Phillips wrote, “Every blow struck on those rails is heard round the globe. Haunt that road with such dangers that none will dare use it.”[14]

Today we need to “haunt” the oil and gas pipelines in support of native people fighting for clean land and water as well as to stand together with all oppressed groups in their struggles. From Black Lives Matter demonstrations to the Standing Rock occupation, and the many other important fights taking place around the U.S. and the world. They are all part of the same fight, for social, economic, and ecological justice.

Unification vs. Big-Tent Problems

In addition to a minimum set of agreed-upon demands, people within a unified movement need to abide by and promote new values among those

involved in the struggle—solidarity, respect for all forms of difference, and sustained support for traditionally marginalized groups. The movement is advanced through changing people right now, promoting ethical behavior toward others inside and outside the movement and personally acting in ways that are socially and ecologically responsible. Vigorous but respectful debate will be required in all these areas based on an understanding that we are all committed to the same project. We need to act in solidarity with one another to the fullest extent possible, and begin to practice values we espouse for the new ecological society: reciprocity, cooperation, honesty, and solidarity.

As more immediate problems are tackled, there is always a danger of insufficient analysis and political understanding, of demands being too loosely defined, or the cause of the underlying problem not being acknowledged. That can lead to a big-tent approach, in which there are indeed lots of people involved: it may look like the movement is growing, but it then becomes a political vacuum dominated by reformists. This results in the absence of demands and actions aimed at actually changing the system. Cash-flush, media-savvy opportunists who act to channel the movement into safe conduits always ultimately fill such a vacuum. The big-tent approach typifies the activities and purpose of the Democratic Party: a vehicle of the elite that anyone can join, with politics that tend to reflect the interests of the ruling elite, which funds and controls the party.

As exciting as it was, the 2014 People's Climate March is an example of how a big-tent approach can lead to a dead end. The organizers, mainly big green NGOs, refrained from making particular demands, claiming that doing so would be divisive. They preferred instead to focus on numbers, making it the "largest climate march in history." Many who participated became disoriented because they were given nothing to do after the demonstration. Though the issue and the desire to do something in the months that followed didn't go away, organizational problems led to the dissipation of the massive energy and momentum crystallized in the giant demonstration. Nevertheless, getting tens of thousands of people to come out to a march against climate change illustrates how many people want more to be done to protect our Earth and rein in fossil fuel production, as well as the willingness of many groups to come together in a common struggle. This is an extremely hopeful sign and one that could be built on.

Rather than the more traditional and grassroots method of organizing people, most NGOs focus on a variety of top-down strategies such as legal challenges, public relations campaigns, media stunts, and funding friendly candidates for local, state, and national offices. At the same time as NGOs have risen in importance, labor unions, especially in the developed world, have become more and more top-down and undemocratic. They are organized in such a way that rank-and-file workers are effectively excluded from active participation in determining campaigns or strikes. Occasionally, supporters of NGOs and union members are asked to sign petitions, write emails or call government officials but their input is limited to a supporting role (and in the case of NGOs, constant requests for donations). Some organizations turn to demonstrations or civil disobedience to garner publicity and wider support. Occasionally, large mobilizations are organized but any demands, goals, and demonstration details are kept firmly in the hands of the large NGOs with money and resources.

An absolutely essential ingredient, what used to happen regularly in unions and other mass organizations, is missing from current efforts. This includes getting to know your constituency, finding out what is on people's minds, and carrying out educational activities so that people fully understand the issues they are most concerned with, how they are connected to other issues, and the power relations that need to be overcome. This is sometimes called "deep organizing," and it is what is lacking in most unions and liberal organizations that have jettisoned their radicalism to keep their donors happy or to retain a seat at the table of mainstream political discussion. Yet the history of radical activism indicates that people at the grass roots level need to be involved in setting the agenda and encouragement is needed for local leaders that organically emerge during the struggle.

Labor organizer Jane McAlevey makes clear the critical importance of this approach in her two important books about the labor movement, *Raising Expectations (and Raising Hell)* and *No Shortcuts: Organizing for Power in the New Gilded Age*. Organizations working for real change need to commit to deep organizing resources, as we work to bring together fragmented organizations within a coalition or overarching organizational

framework. As McAlevey explains with regard to labor unions, such an approach widens the support base:

> [It] places the agency for success with a continually expanding base of ordinary people, a mass of people never previously involved, who don't consider themselves activists at all…. [S]pecific injustice and outrage are the immediate motivation, but the primary goal is to transfer power from the elite to the majority, from the 1 percent to the 99 percent. Individual campaigns matter in themselves, but they are primarily a mechanism for bringing new people into the change process and keeping them involved. The organizing approach relies on mass negotiations to win, rather than the closed-door deal making typical of both advocacy and mobilizing. Ordinary people help make the power analysis, design the strategy, and achieve the outcome. They are essential and they know it.[15]

Organization, Vision, and Solidarity

When large segments of the population become *actively* involved in struggle, they become protagonists who produce a new ethics and ideology of equality, solidarity, reciprocity, and concern for collective needs. The issue that Marx raised of "the educator [who] must himself be educated" is one that must be faced during a transition to a new society.[16] Movements and parties need to be aware of the various ways in which dominant forms of social oppression and exclusion can be replicated—even within organizations committed to their eradication. Educating the educator and implementing new ethics during the struggle for change is an essential part of any struggle for a new society.

Examples of groups consciously educating members to help forge new ethics during the struggle for social change were explored in chapter 11: promoting of sharing, cooperation, and equality by the MST in Brazil and the Kurdish and Zapatista movements promoting equality for women. Another example comes from the fight against privatization of the municipal water system in Cochabamba. Oscar Olivera, former executive secretary of the Federation of Factory Workers of Cochabamba, Bolivia's

lead organizer of the water wars in Cochabamba in 2000, described the victory against water privatization and the armed forces of the state: “The people won in Cochabamba because of two things: an all-encompassing cosmo-vision based on indigenous values of reciprocity and solidarity, and organization and coordination at every level.”[17] Its success resulted from the combination of a vision for a radically reordered world that went far beyond control of water and reforming current institutions, allied with a militant and democratic working-class organization.

The ruling class has many weapons at its disposal: virtually unlimited financial clout and control over the media, the education system, the state, the judiciary, the police and the armed forces. What social force exists in society powerful enough to bring the whole system to a standstill?—the mass of people. If we stop working, the machine grinds to a halt very quickly: no more mining, no more transportation, no more production of any kind without the decision of those who do the job. Only the people who do the work, organized across all sectors and borders, possess the power and the motivation to change the system.

Organizational Leadership

In any transition to a new society, and indeed any human endeavor involving many people, leaders will emerge. Even in movements described as leaderless, such as the Occupy Movement, there are people who take responsibility for certain aspects organizing, communications, and facilitating whatever legal and practical maneuvers are necessary and optimal for occupation at the various sites.

In a profoundly democratic society, there will also be people who, because of their particular skills or inclinations, will become leaders. There is nothing inherently wrong with producing leaders—people who take an issue more seriously, accept more responsibility, or have the skills necessary to be successful. But any leadership must be kept accountable to the people. In this regard, we can learn from historical examples and contemporary experiments and model our practices accordingly. This means ensuring that there is no extra pay or perks for serving as leader and that elections are democratic and transparent, with any decision instantly revocable by

another vote. In addition, the practice of rotating key leadership positions in organizations whenever possible serves a number of purposes: promoting transparency in decision making, developing leadership capabilities in more people, and preventing the establishment of a permanent group with its own interests that comes to see itself as separate from the mass of people.

The contention of the right, dismissing all attempts at fundamental change, is that "all revolutions end in tyranny" because humans are corruptible and greedy by nature. In contrast, we understand that humans are capable of a wide range of behaviors, with specific configurations reinforced by the economic and social conditions and values of the society in which they live. The transformation from capitalist behaviors and ethics to those of an ecological society organized so that it is synonymous with ecosocialism will not begin with a revolution. It will be a continuous struggle, one that will require time and conscious effort to bring about, during the struggle and after a successful revolution.

Fighting for Reforms as Part of the Struggle for System Change

In the long struggle ahead, it will be necessary to fight for immediate gains and genuine reforms that help us live better right now and at the same time build the confidence and organization that can take on the system in a revolutionary reconstitution of social power. This in no way negates what we have argued earlier: reforms by themselves do not offer a way out of the plight we're in. Radical social and ecological organizations need to unite in order to fight together for large and small social and ecological battles that might possibly be won in the near to medium term—but they must do so certain in the knowledge that a revolution is ultimately necessary to end capitalism and transition to a cooperative, fully democratic society based on equality and ecological sustainability. Individual demands need to be made within that framework, one that pushes beyond what the system could possibly accommodate.

A revolutionary transition won't come about without a very long period of tireless and persistent organizing and struggle. When one examines the struggle of slaves and abolitionists to end slavery in the United States, it is

clear that the fight to replace the social-economic system of capitalism with one at the service of humanity and the biosphere on which it depends will necessitate an even more massive struggle. This may take decades, perhaps significantly longer.

Successful struggles for reform will alleviate, slow down, and prevent some of the ecological and social damage endemic to capitalism. They will provide possibilities for educating others to the necessity for systemic change. Victories, however small—such as winning a local strike or banning tar sand oil from a city—provide a needed lift for activists and generate enthusiasm, confidence, belief, and trust in one another, thereby nurturing stronger organization for the next fight.

Every victory, no matter how small, builds confidence and organization. Each victory needs to be considered as part of the larger struggle for change. This includes our demands and fights for full economic, social, and political equality for people of color; indigenous rights; an end to the scourge of hunger and poverty amid plenty; full and equal rights for women; the introduction of renewable energy sources and the end of fossil fuels; empowerment of workers through unionization; full equality for transgender people; more resources for public education; cancellation of student debt and the debt of developing countries; an end to discrimination against immigrants, Muslims, and refugees; more hospitals; well-paid, unionized jobs for everyone; an end to endless wars; and vastly increased taxes on the rich and corporations.

The list of necessary reforms is long and there is always the danger of activists taking up only single-issue causes or getting caught up in striving to win limited reforms, believing that they can solve our problems while retaining the basic structures and tenets of capitalism. In a prolonged struggle there is also the danger of losing faith in an alternative future altogether. Ways must be found for participants in a revolutionary struggle to find other meaning and joy aside from their participation in the fight. This will help people maintain their spirits and commitment over the long haul.

Repression and Resistance

Ruling elites across the world have used neoliberal ideology to argue against any alternative to the capitalist system and its rationing of goods through markets. This includes an ongoing effort to cut social services. In 2009, David Harvey described the level of repression that is arrayed against those who fight for a different world:

> The last thirty years … has seen the emergence of systems of governance that seem immune to legitimacy problems and unconcerned even with the creation of consent. The mix of authoritarianism, monetary corruption of representative democracy, surveillance, policing and militarization (particularly through the war on terror), media control and spin suggests a world in which the control of discontent through disinformation, fragmentations of oppositions, and the shaping of oppositional cultures through the promotion of NGOs tends to prevail with plenty of coercive force to back it up if necessary.[18]

When an effort to change some aspect of the system is deemed a threat, the armed power of the state, and its control of the law and criminal justice systems have been used time and again to crush groups that threaten the existing order. Sometimes the groups are fighting for truly revolutionary change, but sometimes they are just trying to improve their immediate situation within the system. Movement groups of all types in the United States and elsewhere—socialist and communist parties, anarchists, civil rights groups, Native Americans, striking workers, women, immigrants, environmental activists—have been relentlessly targeted and attacked by the government or their surrogates. This can take many forms: infiltration by agents provocateurs, disinformation campaigns, laws enacted against a group's existence or activities, physical disruption of peaceful demonstrations, frivolous but costly legal cases, arrests to slow momentum and consume scarce resources, and targeted assassinations of leaders.

The great fear of authorities everywhere is that, as social movements grow and people expand their political horizons and begin to generalize from their situation, reform may spill over into revolution. In a rerun of the nefarious activities of the FBI and CIA during the civil rights and Vietnam War era, activists are increasingly likely to be targeted by law enforcement

agencies and labeled as “domestic terrorists.” Whistleblowers such as Chelsea Manning and Edward Snowden are vilified and, whenever the opportunity presents itself, imprisoned.

Even relatively minor challenges to the power of the ruling class, such as the Occupy Movement, are met with a robust, uncompromising, and coordinated reaction from the ruling elite, all the way up to the White House. There is a very low threshold of tolerance for active signs of discontent that in part comes from the volatility and instability of twenty-first-century capitalism.

We can therefore anticipate that to replace the entire social-economic system of capitalism—with its financially and politically powerful corporations and institutions and its monopoly on the use of force—a truly gigantic movement will be required, one that mobilizes all sectors of society, such as what we saw briefly during the Arab Spring. James Baldwin’s observation quoted at the start of the chapter is applicable: if even reforms within the system, such as civil rights legislation, will be fought with the utmost tenacity and brutality, the reaction of the ruling class to attempts to overturn the entire system will be ferocious. Even after a future decisive election victory by those seeking to create a new society out of capitalism by using democratic means, the elite will use every economic, political, and military lever they have to oppose any such change

Ultimately, we need to create a movement large and formidable enough to challenge the entire power structure of capitalism, one that is capable of winning the army and large portions of the population that up to that point had been passive, ambivalent, or even antagonistic.

The Need for Internationalism

As the still volatile situation in North Africa demonstrates, to succeed even for a short period of time against the forces interested in maintaining the status quo, strong domestic revolutionary political organization must expand internationally to achieve genuine revolutionary change. If a country, or even a whole region, remains isolated and under attack internally and externally by the forces of capitalism and imperialism, it cannot hold out for long. This is especially true when revolutions break out,

as they have tended to do, in less developed countries with fewer resources to sustain an independent ongoing struggle and subject to greater pressures from outside.

Thinking and acting internationally, instead of focusing entirely on events within a single country, can be seen in the struggles and political outlook of some indigenous communities. Networks such as the Civic Council of Popular and Indigenous Organizations of Honduras (COPINH), founded in 1993 by the recently assassinated environmental leader, Berta Cáceres, and the International Indian Treaty Council, consisting of groups from North, Central, and South America, the Caribbean, and the Pacific are the inheritors of a long tradition of pan-continental and international organizing for justice. Internationalism has long been the principal foundation of indigenous and socialist organizing and is even more critical today. When manufacturers constantly threaten to relocate businesses to other countries or bring in scabs from other regions to break strikes, solidarity among geographically distant workers is imperative if struggles are to be successful.

Learning from History

Political disappointment with organizations that once held the hope of millions for a better world is not hard to find. The African National Congress (ANC) was an organization of committed activists involved in a decades-long struggle for black freedom in South Africa. But since coming to power in the country's first democratic elections in 1994, the ANC—with assistance from representatives of international capital such as the IMF and the World Bank—has strayed far from its emancipatory roots and the vision of its founders, imposing what South African activists have dubbed "economic apartheid." Many former activists who became part of the government bureaucracy have been co-opted and corrupted. Instead of transforming the country into a more egalitarian society as planned by the ANC, the government maintained the neoliberal economy of the previous apartheid regime. In the midst of the second wealthiest and most technologically advanced country in Africa, abject poverty and landlessness coexist with historic white privilege and a newly privileged and enriched

black business class in an unstable, socially explosive, and contradictory combination.

Dismantling the Capitalist State

Over the last few years, very large resistance movements have arisen around the globe—in North Africa, Latin America, Europe, China, and the United States—but these movements have found it difficult to sustain themselves over the long term. In part, this is due to the failure to set up at the grass roots new, united, democratic political organizations that people trust to serve their interests. The rebirth of interest in political organization and the formation of new left-wing parties around the world should be embraced as a promising sign of things to come, and a sea change in activists' understanding of what will be required to win back some of the social gains that have suffered retrenchment over the last forty years. However, as we have seen with recent setbacks in these countries, without democratic control from below that can hold the leadership accountable, and with the old state apparatus and economic power of the wealthy intact, things can all too easily revert to a left-tinged version of the status quo.

For a meaningful transformation to occur, the government and economy of a capitalist nation must be taken over, the power to make decisions and act must be transferred to the people en masse, and people must be willing and able to experiment with the practices, processes, and procedures commensurate with healing the social-ecological crisis. In addition, they will need to absorb the multifaceted and revolutionary cultural and social shifts necessary to do so.

Can the power to transform society be achieved by working through the electoral process? While the electoral process can be effective and useful, and should not be dismissed as an avenue for activism, a government cannot just be taken over through elections and used to build a new society. The current economic structures were designed to maintain the power of the capitalist elite, to permit the exploitation of people and the environment, and to facilitate the accumulation of capital. When electoral campaigns are the exclusive undertaking of a movement or party, most people function largely in a passive mode, limiting their involvement to voting for

representatives of a political party that will carry out change on their behalf. If a movement that wants to change the system is only organized in a passive and limited way around an electoral campaign, it will be in a weak position to withstand a coordinated ideological, economic, and military assault by the capitalist class.

Political democracy is not the same as economic democracy, and both are essential. Samir Amin has explained this as follows:

> I think that the reason for the failure of electoral democracy to produce real change is not hard to find: all hitherto existing societies have been based on a dual system of exploitation of labor (in various forms) and of concentration of the state's powers on behalf of the ruling class. This fundamental reality results in a relative "depoliti-cization/disacculturation" [disinterest in politics and psychological removal from the dominant culture] of very large segments of society. And this result, broadly designed and implemented to fulfill the systemic function expected of it, is simultaneously the condition for reproduction of the system without changes other than those it can control and absorb—the condition of its stability.[19]

Problems encountered by past attempts to change capitalist societies, such as those encountered by Egyptians during the 2011 Arab Spring, point to the need for a rapid takeover of real political and economic power. Community and worker councils need to be set up to make economic and political decisions, workers and farmers need to control workplaces, and decisions must be made in conjunction with the needs of surrounding communities. Groups representing larger geographic areas can plan for the needs of regions and the entire country. There must be a rapid transition away from state-run and private capitalist control of productive and financial resources to control by workers in individual production facilities together with local, regional, and multiregional assemblies of the people. Elected representatives must receive no more pay or benefits than other workers, be subject to instant recall and have no set terms, ensuring that the needs of the people are seen as paramount and that a new government doesn't eventually adopt different priorities.

One of the lessons from the history of attempts to replace capitalism is that the struggle will continue even after a successful revolution institutes a new society. The current system's deep-seated ideologies and ways of thinking and behaving will remain. As Marx said, after a revolution, a new society "emerges from capitalist society; which is thus in every respect, economically, morally, and intellectually, still stamped with the birthmarks of the old society from whose womb it emerges."[20] Unless this issue is understood and proactively approached, old ways continue or creep into the new system, potentially overwhelming it and leading to the reintroduction of some form of class rule. A long transition is to be expected—even after the power to make decisions is in the hands of the people—to reach a fully developed society based on social equity and ecological principles.

Toward a Revolutionary Transformation

It is the job of everyone who wishes to see a better world, one that we have demonstrated is eminently possible, to take up the fight. How that looks will be different in every city, region, and country. But the common thread will be the objective of building the strength of our movement, thereby weakening their capitalist system. Whenever people move into individual struggles, we must be with them and seek to expand, deepen, and connect their separate struggles into one unified fight against capitalism. Whether the issue is police brutality, the building of new oil or gas pipelines, the erosion of voting rights or workers' rights, the vilification of Muslims or immigrants, sexism in the workplace or elsewhere, or some other battle for social and economic justice and a healthy environment, we must take it on.

The struggle is really about the need to change the balance of forces, to educate others and ourselves about what is needed and what is possible. The ultimate goal is to replace the system of capital with an economic-political-social system designed for the purpose of enabling all people to reach their full human potential in ways that respect and preserve a healthy stable biosphere. And from there, people will need to discuss, decide, and plan how best to create or implement the necessary changes. Revolution is a continuous process. It doesn't end with triumph in an individual country, or even in all countries, but continues for generations, even after people are

born who have no direct knowledge of a social system based on class inequality, racism, sexism, war, competition, and greed.

That is the vision of a world worth fighting for. It gives meaning to one's life.

¡La lucha sigue!—¡Hasta la victoria siempre!
The struggle continues!—Ever onward to victory!

Notes

Foreword

1. Frank Benjamin Golley, *A History of the Ecosystem Concept in Ecology* (New Haven: Yale University Press, 1993), 2, 207; J. Donald Hughes, *Pans Travail* (Baltimore: Johns Hopkins University Press, 1994), 4. Haeckel's focus on ecology as the study of the economy of nature was directed at Darwin's view of the competition of species for environmental niches: "All organic beings are striving, it may be said, to seize on each place in the economy of nature." Charles Darwin, *The Origin of Species* (Cambridge, MA: Harvard University Press, 1964; facsimile of first edition), 102. Darwin used the concept of the "economy of nature" throughout his magnum opus.
2. Epicurus, *The Extant Remains of the Greek Text Translated by Cyril Bailey* (New York: Limited Editions Club, 1947), 145, 161, 171. It should be noted that although the ancient Greeks perceived the world dialectically and recognized with some horror the systematic estrangement associated with the money economy, their society was nonetheless rife with contradictions, more so perhaps than other societies in their day, which were related to the development of the property relation. Among these was a more extreme enslavement of women than in the societies surrounding them. At the same time, the polis at its roots was a system of slavery. On the latter see G. E. M. de Ste. Croix, *The Class Struggle in the Ancient Greek World* (London: Duckworth, 1981). Among the ancient schools of philosophy, only Epicureans admitted women and slaves.
3. Richard Seaford, *Ancient Greece and Global Warming* (London: Classical Association, 2009). Coinage is thought to have developed in the West first in Greece's neighbor Lydia and then was given systematic form in the Greek city-states. Although the indications are that China developed a form of coinage earlier, its systematic character, significance to the society, and pervasiveness remain open questions. Quite apart from this, Seaford argues that the Greek adoption of coinage on a large scale and systematic basis, creating a money economy, was a sui generis development—one that separated the Greek city-states from the Near East and India, where a coinage-based money economy developed later. Richard Seaford, *Money and the Early Greek Mind: Homer, Philosophy, Tragedy* (Cambridge: Cambridge University Press, 2004), 4, 129–136.
4. Ovid, *Metamorphoses*, trans. and ed. Charles Martin (New York: Norton, 2004), 298. The above account of the Erysichthon myth follows Ovid, except with reference to the banquet hall, which is included in Seaford's account, which also relies on Callimachus's version of the myth.
5. Seaford, *Ancient Greece and Global Warming*.
6. Seaford, *Money and the Early Greek Mind*, 1–20, 125–136, 147–172.
7. Karl Polanyi, *The Great Transformation* (Boston: Beacon Press, 1944), 178.
8. Francis Bacon, *Novum Organum* (Chicago: Open Court, 1994), 29, 43. On Bacon and the domination of nature, see William Leiss, *The Domination of Nature* (Boston: Beacon Press, 1972), 45–71.
9. "The Web of Life is woven: & the tender sinews of life created / And the Three Classes of Men regulated by Los's hammer." William Blake, *Collected Poetry and Prose* (New York: Random House, 1982), 100.

10. See Karl Marx, *Capital*, vol. 3 (London: Penguin, 1981), 949; John Bellamy Foster, *Marx's Ecology* (New York: Monthly Review Press, 2000), 141–177.
11. Arthur G. Tansley, "The Use and Abuse of Vegetational Concepts and Terms," *Ecology* 16, no. 3 (July 1935): 299–300, 304; Joseph Lester, *E. Ray Lankester and the Making of Modern British Biology* (Oxford: British Society for the History of Science, 1995), 185–87; Peer Ayres, *Shaping Ecology: The Life of Arthur Tansley* (Oxford: Wiley-Blackwell, 2012), 41–44. It is worth noting that the word "œcology" first entered English in the 1873 translation under Lankester's supervision of Haeckel's *History of Creation*. See *Oxford English Dictionary: Compact Edition* (Oxford: Oxford University Press, 1971), 1975.
12. Peder Anker, *Imperial Ecology* (Cambridge, MA: Harvard University Press, 2001), 152–156.
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14. See J. R. McNeil and Peter Engelke, *The Great Acceleration* (Cam-bridge, MA: Harvard University Press, 2014); Ian Angus, *Facing the Anthropocene* (New York: Monthly Review Press, 2016).
15. Rachel Carson, *Silent Spring* (Boston: Houghton Mifflin, 1962); John Bellamy Foster and Brett Clark, "Rachel Carson's Ecological Critique," *Monthly Review* 59, no. 9 (February 2008): 1–17.
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21. Karl Marx and Frederick Engels, *Collected Works*, vol. 42 (New York: International Publishers, 1975), 558–559.
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    1 percent of 2 million lbs = 20,000 lbs of organic matter per acre (per percent organic matter).
    Organic matter is estimated to be 0.5882 percent carbon.
    Therefore the weight of *carbon* in the top 6 inches of soil = 11,764 lbs of C *per percent organic matter*.
    B) The amount of carbon in atmosphere per acre of earth surface area: The surface of the earth is equivalent to 126 billion acres (surface area of earth in acres).

The mass of carbon dioxide in atmosphere = 3×10^{15} kg = 6.6×10^{15} lbs of CO_2 (http://igss.wikidot.com/co2mass).

C) Carbon makes up 27 percent of CO_2 by weight (12/44); thus there are 1.78×10^{15} lbs (27 percent of 6.6×10^{15}) of carbon as CO_2 in the atmosphere.

D) Now divide 1.65×10^{15} lbs of C in the atmosphere by 126 billion acres (1.26×10^{11} acres) = 1.4×10^{4} lbs = 14,127 lbs of C as CO_2 in the atmosphere above each acre of earth compared with 11,764 lbs of C per percent organic matter.

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    > No piece of coal or drop of oil has yet turned itself into a fuel, and no humans have yet engaged in systematic large-scale extraction of either to satisfy subsistence needs: fossil fuels necessitate waged or forced labour—the power to direct the labour of others—as conditions of their existence…. That is the point of contact between humans and the rest of nature, where biophysical resources pass into the circuits of social metabolism…. That is the sphere where the fossil economy must have originated.

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